Electrical World

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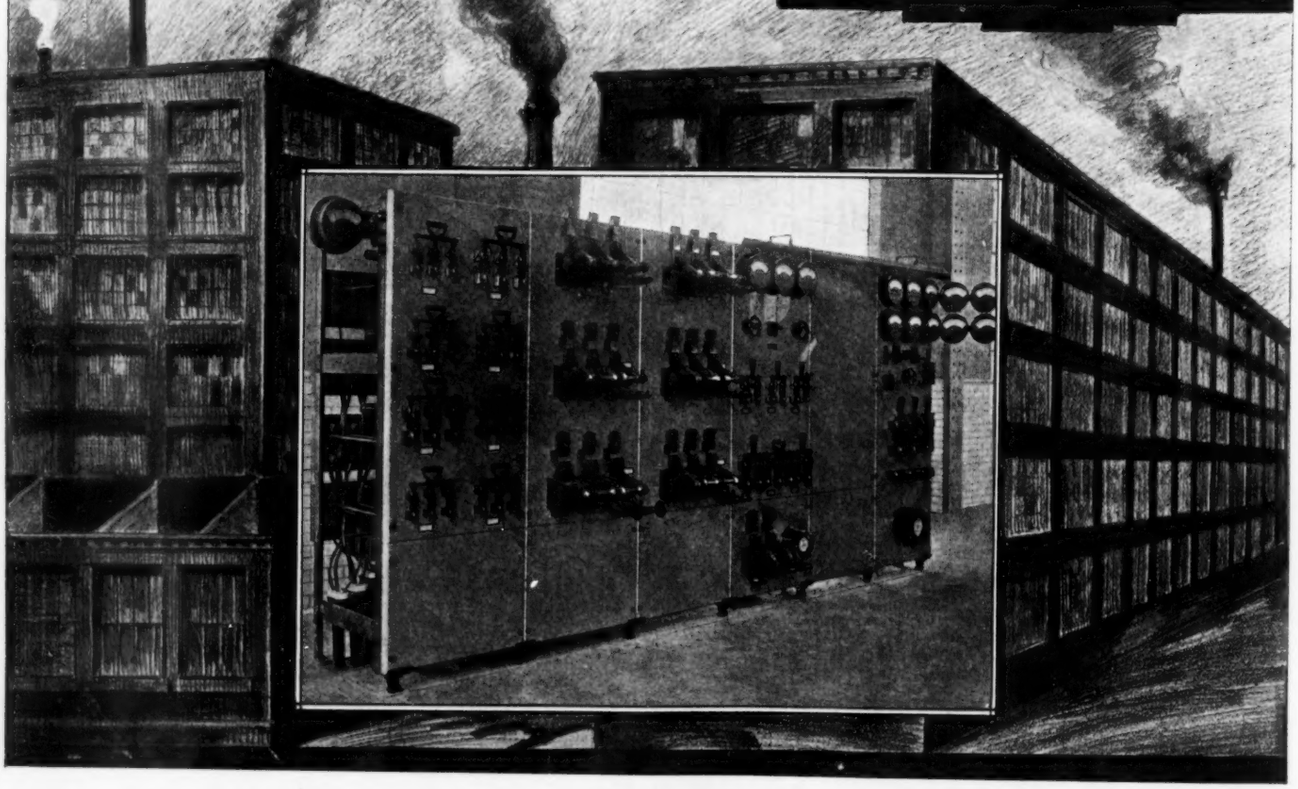

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Institute Invites Comment

THE board of directors of the American Institute of Electrical Engineers has decided to submit the report of the committee on development to the entire membership for comment. This is as it should be for the good of the profession, and now that the members have the official report before them for the first time we trust they will be prompt with their suggestions. They owe it to themselves and to the Institute that nothing be enacted by default. Discussion at the Lake Placid meeting was too meager and the responses from the sections were too few to be representative. No satisfactory conclusions could be based on such limited and conflicting testimony. Every fellow and member should therefore make it a point to be heard from because they are most vitally concerned in the outcome, and no associate should refrain from making his thoughts on the subject known. The committee and the Institute will welcome full discussion and profit by it. Moreover, we are confident that if sober and serious thought be given by the membership to the problems confronting the Institute, a solution will be forthcoming which will not do violence to its dignity and prestige and which will make for increased devotion to the profession and added interest as well.

Passenger trains are all crowded; hotel rooms are available only for those who wire ahead; vacant houses and apartments in large cities and small towns alike are difficult to find; the whole country in short is lacking in ordinary living accommodations. With this situation existing and probably destined to continue for a considerable period, how can the electrical industry expect anything but sure prosperity? The optimists of the industry will soon come into their own.

Rates for Street Lighting

DEMANDS for rate reductions in street illumination at the time of contract expiration or renewal often have no economic justification. Much emphasis has been laid upon the steady long-hour load of the street-lighting installation in urging downward rate revisions, but this electrical advantage is to a large degree offset by the inflexibility of the equipment. From the bus connections to the constant-current transformers, through the rectifiers, switchboard equipment, overhead and underground lines and lamps themselves, the central stations maintain expensive apparatus useless for any other service by day and idle many hours in early evening and late morning each year. As for the beneficial effect of the street-lighting load upon station efficiency, it is easy to exaggerate this in view of the small amount of energy required for street lighting even in a large city, as compared with the capacity of the units required to handle the commercial power and lighting service.

Present construction and operating costs are sharpening the wits of the engineering profession to realize a more efficient use of money wherever possible. As the purchasing power of the dollar falls the incentive to spend expertly increases.

Valuation and Rate of Return

THE problem of what method of valuation shall be adopted is sure to arise again, and those who are interested will find it desirable to study the effect of conditions as applied to their individual properties. If a valuation were made to-day, would commissions ignore the ascending price scale in labor and material at which the whole world looks in wonder? Could it be said fairly that the value of a plant to-day is not what it would cost to build it now but what it did cost when prices were lower? If the value is fixed arbitrarily at original cost, it means that the owners of a property who bought and built in a period of low prices would be deprived of any advantage resulting from enhancement. The question, of course, assumes another angle when it is suggested that the price level might have gone down instead of up. But if one takes a five-year average of prices, as was the practice of some of the commissions, value allowed now would still be far greater than in any previous period. If it is fair to apply price average with the result of reducing the amount to compute the return on, then it is fair to apply it when the effect is to increase the amount on which return is figured. It is not justice to accept the doctrine when it is in your favor and reject it when it is against you. From this general outline of issues contained in the entire large subject it is plain that in the present world-wide disarrangement of the old-time normal scale of costs the question of value has a new relation to that of the rate of return.

Rate of return, taken by itself, has certainly undergone changes which find their expression in startling revisions of cost of borrowed money and interest and dividends on securities. In all of these changes the sound electric utility properties, progressing steadily in output during the world conflagration, have found their costs of new financing made higher. Old outstanding issues of their bonds netting around 5 per cent interest have not been affected in the same degree as have the mortgage obligations of steam railroads and many municipal issues which formerly sold at very low interest yields. But new issues of electric utilities have

usually found markets only at higher rates on their face or by reason of lower price concessions to the bankers. In the actual war-time strain the cost of money for electric utilities was absolutely excessive. It was justified only by the urgent necessity of national peril which forced additions to plant. That the higher price level applies to interest rates, though it does so very unevenly owing to different circumstances, is shown by the rates paid by the national government. Another matter which is pertinent in this connection is the fact that an owner of public utility securities who gets the same return in dollars now as before the war gets about one-half of the old return measured in purchasing power. We can scarcely expect to progress from 8 per cent to-day to 16 per cent to-morrow in order to rectify this condition at one step. The problem is not one that will be solved easily with justice to every one, but, like the problem of making a rate that will attract new capital, it is there and it will call for the exercise of ability and clear judgment on the part of commissions and the operating and executive officials of central-station companies.

Recent events in the telephone field indicate that that branch of the electrical industry has found a means of taking a new lease on life. Profits from new capital expenditures along old lines of development had almost ceased to appear attractive. But now comes the revival of interest in the automatic telephone, with the consequent saving of labor and its flexibility for working in connection with manual systems already installed.

A Big Air-Break Switch

THERE are many cases in power transmission practice in which air-break switches are valuable. In particular, when branch lines of moderate capacity are connected to a high-tension circuit a cheap and effective outdoor switch is needful and the air-break type fills the bill. It has been widely and successfully used for a long time on the Pacific Coast, and while it cannot well replace the oil switch for all purposes, the latter is too costly for universal application. The outstanding question is the maximum capacity for which the cheaper switch is well adapated, and our readers will therefore be interested in George T. Southgate's account of an example in regular use on a 100,000-volt circuit, breaking up to 5000 kva. It is capable of regularly breaking the charging current on a 100-mile (160-km.) line, handling the load on branch lines or serving as an efficient disconnecting switch in station work.

Its construction and operation are well shown in the article. The insulators carrying the contacts and horns rotate on their own axes, the separation taking place along curved surfaces instead of in a vertical plane through the two insulators. The mechanical arrangements, as will readily be seen, are simple and effective, and the operating gear is very handy to work. Switches of this type can be readily made for emfs. all the way up to 110,000 volts, the figure reached by the one here described, and should prove useful for a wide range of operation. There would seem to be a large field for such apparatus on many systems where the expense of high-voltage oil switches would be almost prohibitive, and the present experience tends to show that loads of considerable magnitude can be conveniently dealt with by means of the air-break device.

A Condenser Extraordinary

IN THESE days of high voltage one is prepared for apparatus designed for almost any electrical pressure which may be found useful, yet the big condenser described in our columns this week stands upon a plane of its own. It was especially intended for experiment upon insulators and insulating material at emfs. up to 500,000 volts and frequencies up to 60,000 cycles. It is an air condenser, of course, considering the frequency, built from sheet metal with edges curled up to a 12-in. (30-cm.) radius. Some idea of the magnitude of the structure may be gained from the fact that the movable upper plate is 15 feet by 30 feet (4.5 m. by 9 m.). Current at such immense frequencies as are used in radio work is supplied by a Poulsen arc converter rated at 30 kw. The testing lead from this gigantic condenser is unique, being a 10-inch (25-cm.) sheet-iron pipe, like a huge stovepipe, about 20 feet (6 m.) long, reaching from the condenser house to a testing platform in front of it. The arc converter is attached to the lower plate, and the capacity of the affair is limited only by the dielectric strength of the air between lower plate and ground. At the full pressure of 500,000 volts the arcing distance reaches 9 feet (2.7 m.). This gigantic apparatus is a striking illustration of the magnitude involved in modern power engineering.

Electric service rates are conspicuous for their fairness to the public and to the serving utilities. If this were not so, the fierce light of investigation would long ago have disclosed conditions adverse to healthy development and to good relations within and without these organizations. Charges of profiteering find no target worth hitting in the field of energy supply in comparison with the state of affairs in not a few other lines of business.

Electrically Welding the Liberty Motor

AS IS now well known, the Liberty motor pulled out into a wonderfully light, efficient and reliable machine; but only those familiar with its construction realize how important a part welding played in giving it its valuable characteristics. It enabled high-grade forgings to replace block castings without loss of the essential solidity and reliability. In all, twelve different types of weld had to be made in completing and fitting a cylinder. These joints were originally designed for gas welding, but some difficulties were encountered, especially through distortion of the cylinder and danger of poor welds by inexperienced operators, so that one large manufacturer soon, with excellent results, shifted to electric arc welding. O. A. Kenyon's description of the working of this process in this issue gives a most convincing idea of the effectiveness and convenience of the scheme. On account of the original design some of the welds were difficult to complete with the arc, but even these could be accurately placed and spot-welded with the arc, leaving completion only to the gas. Only in one or two instances was complete gas welding found to be the more convenient. The matter of the design of joints for the kind of welding to be worked is an important one and accounts in large measure for the varying degree of success attained by makers of Liberty motors in working the electric process. The essential feature of the Liberty motor design was adaptability to quantity production, and to

this end electric welding seems to have been well suited to its task. One of its striking advantages is the ease with which it can be subjected to automatic control, which is of great value in simplifying the work of the individual operator.

The steam railroad industry is organized for the purpose of restoring the properties to private control, economical operation and adequate rates. Electric railways are conducting an organized effort to obtain higher fares. Organizations of the electrical industry extend into every branch of its activities, but do they pull together, like the crew in the racing shell, at each stroke?

Army Radio-Telephone Development

IN THE issue of Aug. 16 a very interesting piece of radio-communication history was presented, drawn up by three United States Signal Corps officers. It relates to the development of airplane radio-telephony in voice-commanded army airplane squadrons. When an airplane squadron starts from its base for a given objective the pilots usually receive detailed instructions as to their order and formation of flying, their courses, duties and procedure in returning. This is all very well if the program laid out can be adhered to throughout. In warfare, however, the unexpected is likely to occur, and the plans of the squadron commander are likely to be completely changed by the course of events. When changes happen in the air they come with amazing swiftness, and there is no time for the commander to signal to the other planes what new orders they should follow. Consequently, all organized and collective action is likely to be interrupted by a sudden occurrence of a few seconds' duration. If, however, the commander can keep within radio-telephonic range of his squadron, he can expect to maintain squadron formation and maneuver under adverse conditions. The range does not need to be great; in fact, there are advantages in keeping it down to a few kilometers. The commander is the only one who needs to speak, as a rule, and the other airships have only need to hear. A voice-commanded squadron is, in an operative as well as a military sense, very much more than a mere airplane squadron without radio communication.

The difficulties in the way of making practical airplane radio-telephone sets were very great at the entrance of America into the war. As a single instance, it has only to be recalled that an airplane is probably the most difficult place, in earth or heaven, in which to work a telephone, on account of the deafening noise of the engine. The overcoming of this difficulty meant the production of a portable sound-proof telephone booth holding only a few cubic centimeters of volume; *i.e.*, a helmet with earpieces fastened so tightly over the ears that the sounds from the internal receiver would be audible and yet engine and wind noise be excluded.

The article describes in outline the successive steps of the development work and shows that within twelve months the aim was successfully attained. This achievement called for extensive coöperation between many workers both in the Signal Corps and in the factories. The results are likely to be of great permanent value in times of peace, although the emphasis is likely to be directed less toward squadron movement and more to long-distance reception of air messages, by radio-communication, between airships and the ground.

Current Practice in Transmission Systems

THE relation of transmission voltage to distance, spacing of wires and line construction has been the subject of much theoretical discussion, and there have been published in these columns from time to time numerous formulas connecting the various elements of the problem. It is a useful thing, however, to examine the subject in the light of actual practice as it has developed, and from this standpoint the article by Prof. D. D. Ewing elsewhere in this issue is worthy of careful examination. It gives a rather striking view of the development of the art and shows as well the trend of present practice. The data were derived from a study of the conditions in more than sixty high-voltage transmission plants, both American and foreign. An illustration of the article shows the present situation with respect to voltage as a function of length of line. Other things being equal, the longer the line the higher is apt to be the voltage, but we doubt whether any numerical relation established on the figures presented can be considered conclusive, for the reason that the plants really represent various stages of evolution and concurrent effects of distance and amount of energy transmitted, rather than a real adaptation of voltage to distance.

In fairly long transmissions or those involving large powers the tendency has been steadily toward the use of the maximum voltage available in the state of the art. The purpose of raising the voltage is to lessen the line loss, whether from great distance or heavy current. It therefore happens that Professor Ewing's plants arrange themselves in a certain set of fairly well-defined groups, representing successively 60,000, 70,000, 80,000, 90,000, 100,000 to 110,000 volts, each group marking a step in transformer and insulator construction.

Voltage has gone upward, in other words, by jumps, the final one being in the vicinity of 150,000. At each stage the longer the line and the heavier the load the greater the inclination of the engineer to go to a higher voltage. With the voltage the spacing has steadily increased, in each instance keeping well clear of the arcing distance, with a tendency to increase the factor of safety as the voltage rises. With these increases have come considerable increases in the heights of the necessary towers, so that an empirical relation can be established between the required height and the voltage, a relation changing, of course, as one passes from the pin-type to suspension insulators. As the normal length of span does not vary very greatly from voltage to voltage, the tower height is chiefly dependent on the room that is necessary for the insulators and for the provision of a proper factor of safety at the voltage attempted.

The next step will probably be the building of some long-distance plant for very large power, for which the present voltage limit of about 150,000 will for economic reasons be considerably exceeded, probably by reaching not less than 220,000 volts. Up to the present limit of practice, however, Professor Ewing's empirical data give a good indication of the characteristics of plants as they have been built. The increase in costs of copper and of steel is likely to change the distribution of the datum points considerably and to shorten the distances at which engineers will be disposed to play the limit in voltage.

Liberty Engine Welding Plant

Closed-Circuit Arc-Welding System Used to Eliminate Distortion—Description of Joints Which Are Adapted to This Process—Special Control Boards and Their Operation

BY OTIS ALLEN KENYON

WELDING made the Liberty engine possible. It enabled the designers to use a forged cylinder to which forged valve cages and cylinder parts were welded, the water jacket being welded over the assembled cylinder. Although the joints were originally designed for gas welding, it soon developed that whereas the gas method was highly successful for jacket welding, it was very unsatisfactory for valve cage and flange welding, both of which were fairly

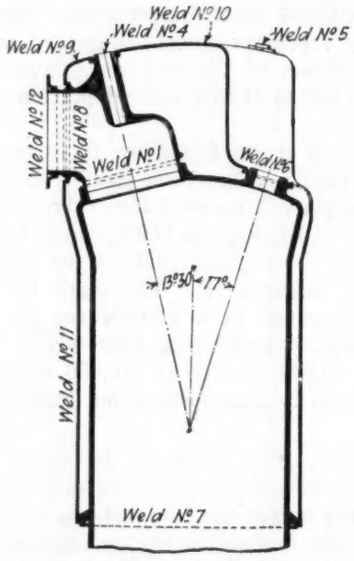


FIG. 1—CROSS-SECTION THROUGH LIBERTY ENGINE CYLINDER TO SHOW TYPES OF WELDS INVOLVED (SEE FIGS. 2 AND 3)

heavy welds. The troubles with gas welding were distortion of the cylinder by the heat and the making of poor welds by operators who were not sufficiently trained. The distortion from heat was so serious that one of the manufacturers decided to investigate the closed-circuit arc-welding system with a view to eliminating distortion. Tests showed that this system of welding produced no distortion that could be detected by ordinary methods of micrometer measurements, and it was suggested by the writer that certain changes be made in the design of the various joints and that tests be made on all the various welds. These recommendations were followed out, and the result was a decision to use the closed-circuit system for all welds on the cylinder.

To make it clear what types of welds were involved, a section of a cylinder is shown in Fig. 1, one-half being taken 90 deg. from the other so as to show all welds. The designs recommended for the various joints are shown in Fig. 2.

Joint 1 is so designed as to locate accurately the valve cages on the cylinder and thus permit the assembly after the machining operations are complete. The advantages of this method are that the cylinder barrel and the two valve cages can be machined separately and only such scrapped as are actually defective. When machining operations are done after the welding is completed any error on one part scraps all three. In preparing for welding, joint No. 1 was assembled and clamped into position, the abutting surfaces locating the parts. Then the weld was put into the groove and the contraction of the weld was utilized to pull the two parts into perfect position.

Joints 2 and 3 were made by gas, as the arc could not be brought to bear on all parts of the joint. However, in actual practice they were located and spotted by the arc and then welded by gas.

Joints 4, 5, 6 and 8 are all of the same nature, namely, bosses of relatively massive metal, having high heat-dissipating capacity; too light sheet metal has low heat-dissipating capacity. This joint depends largely for its success upon the fit of the jacket to the boss. Most important of all it is that the jacket shall sit down firmly on the flange below it; secondly, the jacket should fit the shoulder on the boss as closely as possible. The first requirement is to give

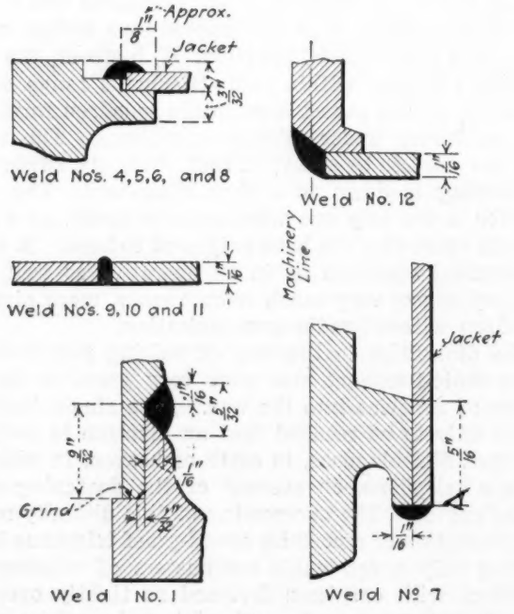


FIG. 2—TYPES OF WELDS EMPLOYED ON LIBERTY ENGINE CYLINDER (SEE FIGS. 1 AND 3)

maximum and uniform heat-dissipating capacity, and the second is to keep the weld as narrow as possible to avoid the possibility of leaks.

Joint 7 is an extremely easy one, so that it does not matter much whether the jacket skirt is above, below or at the edge of the flange on the cylinder. Joints 9, 10 and 11 are seam welds in the jacket and are easiest to make when the jackets exactly butt each other. Joint 12 is easy to make, and gave no trouble

so long as the bottom of the weld was kept at least $\frac{1}{16}$ in. (1.6 mm.) below the machining line.

All these welds, except flange 12, were required to stand a severe leakage test, and therefore they had to be planned and executed with great care.

As was foreseen from the beginning, the straight

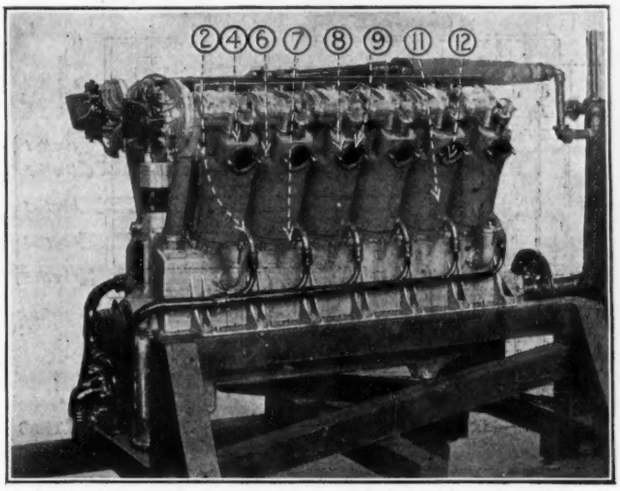


FIG. 3—COMPLETED LIBERTY ENGINE, SHOWING DIFFERENT WELDS

Referring to the welds by number, they are as follows: (1) Valve cage on elbow to cylinder; (2) water inlet pipe to jacket (at top not shown); (3) water outlet pipe to jacket; (4) valve stem to guide boss to jacket; (5) cam shaft housing hold-down boss to jacket; (6) spark plug boss to jacket; (7) jacket skirt to cylinder; (8) port to jacket; (9, 10, 11) two halves of jacket together, and (12) flange to port.

seam welds with no backing, such as 9, 10 and 11, were easier and quicker to make with gas than with the arc, as the arc heat is too intense for thin metals when no backing can be provided to dissipate the heat. Therefore these straight seams, except the first few hundred, were made by the gas process.

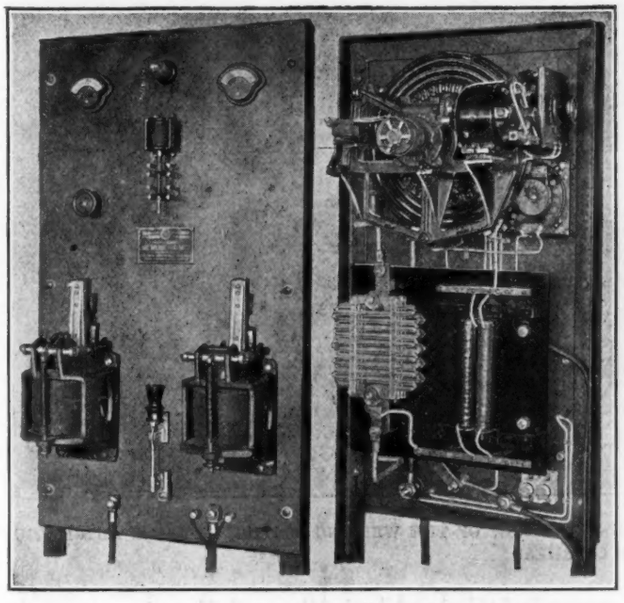


FIG. 4—FRONT AND BACK VIEWS OF REGULATOR FOR WELDING OUTFIT

When gas and arc welding are used on the same job trouble is often experienced. If the arc welding is done first, the heat from the gas welding is liable to set up severe strains due to inability of the part welded to expand freely. On the other hand, if the gas welding is done first, the fit of the joints that are to be arc welded is liable to be disturbed, and in this particular instance poor fit was accompanied by serious consequences. Finally the job was worked out in such a way that both gas and arc welding were used.

When gas and arc welding are so combined that they overlap, experience has shown that the gas welding should be done first and the surfaces adjacent to the arc weld should be cleaned of all scale—otherwise trouble will be experienced from leaks at the points where the two kinds of welding join. In this particular job it proved to be more expedient to combine the welding of the top bosses, 4 and 5, with the top seam which intersected 4. Therefore the final method of handling this was to use gas welding for welds 4 and 5 as well as the top seam.

Another weld that was finally made by gas was No. 7. The reason for this was partly a regard to appearance and partly the lack of sufficient arc-welding equipment. This weld was extremely easy to make with the arc. In fact, the poorest operators seldom

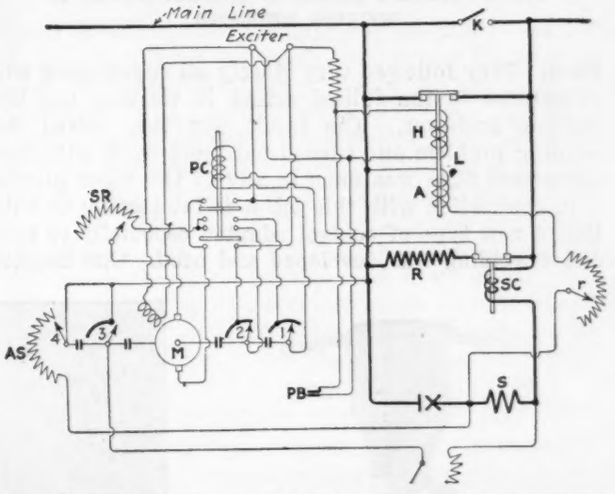


FIG. 5—CONNECTION OF APPARATUS COMPOSING REGULATING OUTFIT

had any trouble making tight welds. However, with the metal arc metal had to be deposited, whereas with the gas it was not necessary to add any metal, the edges being simply fused together. Therefore, although the arc made a quicker and stronger weld, the superior appearance of the gas weld proved to be a deciding factor.

As finally worked out, the thirty arc-welding stations were used to full capacity in turning out cylinders to meet the production schedule, and still gas welding was used for the welds above mentioned.

It should be distinctly understood that the changes from arc welding to gas welding were not made because the arc welding was unable to do the work, as every weld with the exception of the water-jacket pipes was made by the arc process for several months and then when the capacity of the plant proved to be too small the gas welding was introduced.

The particular reason attention is called to the success of arc welding on this job is that other installations of the same kind and for the same purpose were made at other plants and similar results were not obtained. The difference was due primarily to the refusal of the engineers of the other plants to

take advice on the design of joints, welding fixtures and current values and characteristics. They preferred to follow their own untried ideas, and the result was that they never had any real succes with arc welding.

The engineers of the plant here described took just the opposite course. They assumed from the start that men experienced in arc welding could advise

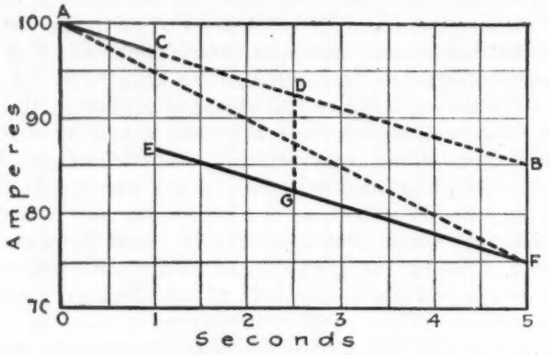


FIG. 6—CURRENT REDUCTION CHARACTERISTICS OF WELDING REGULATOR

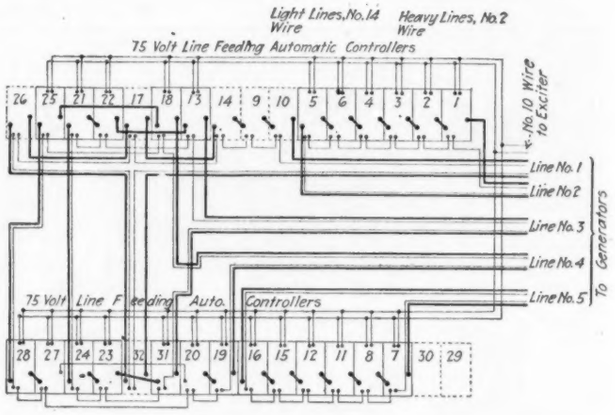

Light Lines, No. 14 Wire
Heavy Lines, No. 2 Wire
75 Volt Line Feeding Automatic Controllers
No. 10 Wire to Exciter
Line No. 1
Line No. 2
Line No. 3
Line No. 4
Line No. 5
To Generators
75 Volt Line Feeding Auto. Controllers

FIG. 7—METHODS OF FEEDING AUTOMATIC CONTROLLERS FROM GENERATORS

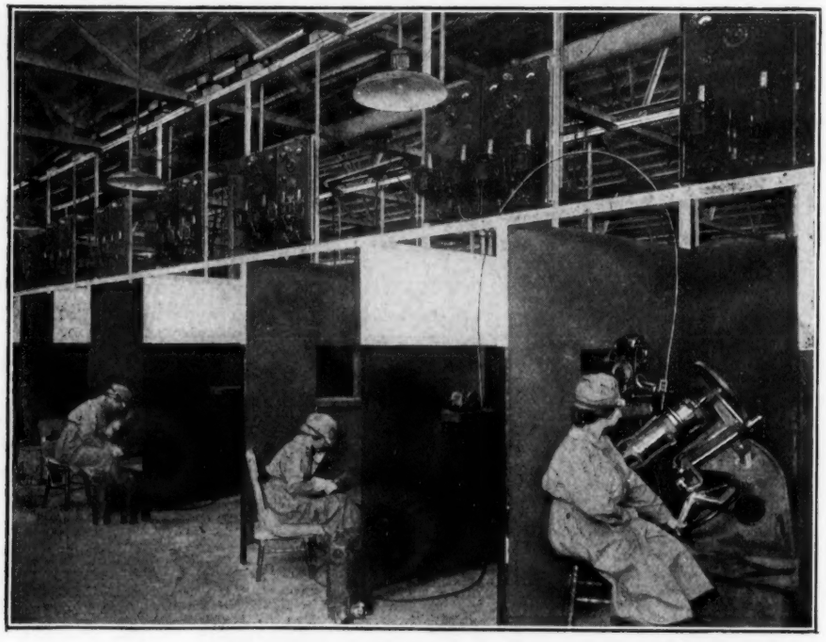
them. They followed very closely all suggestions and coöperated to the fullest extent in working out the welding problems. The result was they solved the welding problem and turned out more work with less equipment than was done in any of the other plants.

In connection with this job it is interesting to note that a new type of control adapted especially to thin metal welding was developed and used. One trouble that is met in welding light metal pressure vessels without leaks is the tendency of leaks to occur at the points where the arc starts and stops. The principal source of this trouble is lack of heat at the start when the metal is cold. Yet if the current is adjusted at such value as to get instant fusion, at the end of a few seconds it will be too great to continue welding without melting metal faster than it can be welded. This difficulty was overcome by a controller designed and patented by the writer which permitted the arc to be started at maximum current and then cut down the current automatically at a predetermined rate to a predetermined running value; then when the arc was extinguished it returned automatically to its stationary position.

Referring to Fig. 5, the operation of the automatic controller is as follows:

The panel switch *K* short-circuits the panel by closing the gap in the closed-circuit main line. When the welding panel is in use the switch *K* is opened. Contactor *L* is normally held closed by holding coil *H*, and contactor *SC* is held closed by a spring, therefore before starting welding the main-line current passes through the short-circuit closed by contactor *L*.

To start welding the operator presses button *PB* in the handle of the tool, which cuts out coil *H* and allows contactor to open. Now the line current passes through starting resistor *R*, which generates enough voltage to start an



FIGS. 8 AND 9—WELDING TOOL DEVELOPED FOR LIBERTY ENGINE JOB; A FEW OF THE WELDING BOOTHS, SHOWING AUTOMATIC CONTROLLERS OVERHEAD

arc. Striking the arc draws current through coil *SC* and cuts out the starting resistor *R*. It also places the pole changer coil *PC* across the arc, and as soon as the arc is established the pole changer lifts, making the circuit through the armature of the pilot motor *M*. The pilot motor drives four arms, 1, 2, 3 and 4. Contact segment 2 limits the travel in the starting direction; 1 limits it in the stopping direction; 3 cuts the main shunt *MS* in, and 4 is the arm of the arc rheostat *AS*.

Before starting, contact segment 2 is the only one that is closed, so that when pole changer *PC* lifts the motor starts and runs until the brush leaves segment 2, which stops the motor. While rotating, the contacts 1, 3 and 4 come into action.

Contact 1 closes the motor reverse circuit, 3 introduces a definite shunt around the arc, and 4 causes a gradual decrease in resistance in the arc shunt, the combined result being to cut down the arc current.

Once the rotation has opened 2 and stopped the motor, everything remains as it is until the arc is extinguished, when contactor *SC* kills the coil *PC* and allows the pole changer to drop, starting the motor *M* in the opposite direction. The rotation continues until 1 opens and in the meantime 2 is closed, so that once the arc is struck the motor is again ready to start as before.

From the foregoing it is evident that the shunting controller cannot move into action until the arc is actually started, and then by adjusting the relative angular position of the contacts 1, 2, 3 and 4, and the resistance of *MS* and *SR*, a great variety of shunting characteristics can be obtained.

A typical arc current reduction characteristic is shown in Fig. 6. In this case the line current is 100 amp. This continues for 2 seconds (*A*), then rheostat arm 4 (Fig. 5) comes into action and begins a gradual reduction of the arc current. At *C* the contact 3 is closed, which for this adjustment of *MS* causes a sudden drop of 10 amp., then the continued rotation of 4 by the motor reduces the current to 75 amp. (*F*), when contact 2 opens and stops the motor.

The object of the fixed step *MS*, instead of a simple continuous rotation by change in speed, is to get a better control of the heating effect independently of the final current and the time. Looking at Fig. 5, it is seen that, although a fixed motor speed is represented by the slope *AB*, and a fixed time, seven seconds, the heat put into the weld during that time can be varied over a wide range simply by changing the timing of the insertion of the shunt *MS*, represented by the line *CE*. If the contact 3 had been set for four and a half seconds instead of three seconds, an increase in the amount of heat represented by the area *CEGD* would have been put into the weld.

From Figs. 5 and 6 it is evident that the following factors in Fig. 6 can be adjusted: (1) The slope of *AB* by changing the speed of the motor *M* with rheostat *SR*; (2) the location of *CD* by adjusting arm 4; (3) the location of *CD* by adjusting contact 2. The whole combination is capable of great variety of adjustments, so that any desired heating characteristic can easily be obtained and once set will be repeated indefinitely.

Although this controller was designed especially for the Liberty engine job, it is equally well adapted to any light metal work where there is an appreciable difference between the heat required to start and that required to continue a weld.

Another interesting phase of the Liberty engine welding job in this particular installation was the method of distributing the energy. In order to save production space and facilitate operation, the welding generators were installed at one point in the plant and operated under the care of the electrical department. From the welding power plant the feeders were run directly to the welding department, where the controllers were arranged to form a double line of switchboards, placed directly over the welding booths. Each controller was adjusted for the particular weld that was made in its booth, and this adjustment was maintained by a switchboard operator who was in continuous attendance. The wiring diagram for the primary distribution is shown in Fig. 7. The secondary circuit was the same in all cases (see Fig. 5), except for those panels which were used for weld No. 12. These were not equipped with the heat characteristic controllers.

SELECTING CONDUIT SIZE FOR POWER-PLANT WIRING

Convenient Curves Are Arranged to Facilitate the Selection of Wrought-Iron Conduit Size for Wiring Layout in Power Plants

BY A. R. ZAHORSKY
Assistant Engineer of the New York & Queens Electric Light & Power Company

THE proper size of wrought-iron conduit to use for the installation of wires and cables for electric power transmission is recommended by the National Electrical Code. The table given in the code applies to 600-volt rubber-covered wires and cables and gives the size of conduit required for from one to four single conductors. For ordinary wiring conditions this is sufficient. In power stations, however, where conductors with various kinds of installations are required, the table is not extensive enough to meet all conditions. For the convenience of engineers engaged in power-plant layout work available data have been arranged in the form of curves from which the proper size of conduit may readily be chosen.

Consider, for instance, the case of a three-phase, four

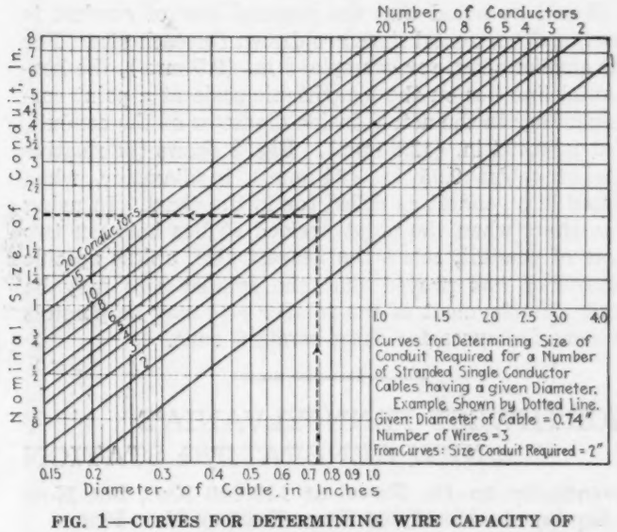

Number of Conductors
20 15 10 8 6 5 4 3 2
Nominal Size of Conduit, In.
20 Conductors
15
10
8
6
5
4
3
2
1.0 1.5 2.0 2.5 3.0 4.0
Curves for Determining Size of Conduit Required for a Number of Stranded Single Conductor Cables having a given Diameter.
Example Shown by Dotted Line.
Given: Diameter of Cable = 0.74"
Number of Wires = 3
From Curves: Size Conduit Required = 2"
0.15 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Diameter of Cable, in Inches

FIG. 1—CURVES FOR DETERMINING WIRE CAPACITY OF WROUGHT-IRON CONDUIT

wire generator requiring two 500,000-circ. mil, 15,000-volt varnished-cambric cables per phase and neutral. It is required to find the size of pipe necessary for running the eight leads from the generator to the switch house. Without convenient data the designer must make a scaled drawing of the conductors and conduit to ascertain the proper size of conduit to be used.

Standard practice shows that to enable the workman to pull in a number of wires with very little difficulty, the total area of cross-section of the conductors lies betwen 35 and 40 per cent of the area of the conduit for runs of medium length. Runs of medium length are such as do not exceed 200 ft. (60 m.) in length for straight runs, 100 ft. (30 m.) straight run with two right-angle bends, or 50 ft. (15 m.) with three right-angle bends.

With the idea of facilitating the selection of the proper size of conduit for any number of cables from

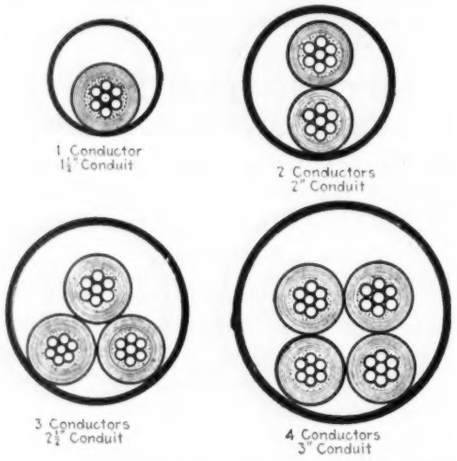


FIG. 2—EXAMPLES TO SHOW HOW CURVE DATA WORK OUT
Cables are 0.95 in. in diameter

one to twenty, having given the outside diameter, the chart, Fig. 1, has been made. An average value of 37.5 per cent is assumed for the ratio of cable area to conduit area because this is a proportion in common use and gives ample leeway for both small and large conductors. Both diameter of cables and sizes of conduit are plotted to a logarithmic scale.

It will be noted that the nominal size of conduit is used, and horizontal lines are drawn for each size. For the smaller sizes, for example, ⅜ in. (9.5 mm.), the horizontal line lies on the logarithmic scale at a point corresponding to the actual inside diameter of the conduit, that is, 0.494 in. (12.6 mm.). Fig. 2 shows the relative size of cables 0.95 in. (24 mm.) in diameter, when placed in a conduit as called for in the chart. In using this chart when the point arrived at lies between two sizes of conduit, select the nearest size, unless specific experience has proved that the smaller size may be used. Employment of the smaller size may be possible in some instances for short straight runs.

NORTHWEST PENNSYLVANIA'S NEW GENERATING STATION

Eventually to Be Rated at 120,000 Kw., but Now Equipped with 16,000 Kw.—Built on Unit Plan—List of Principal Apparatus Used

Following is a list of the chief apparatus, with data regarding its chief features, for the Erie (Pa.) Lighting Company's new generating station. Arrangement of equipment in this station, together with features of construction and proposed methods of operation, were given in detail in the July 12 issue of the ELECTRICAL WORLD:

BOILERS, B. & W. Longitudinal Drums

Rated hp	846
Number units installed	6
Steam-making surface, each, sq.ft	8,460
Pressure for which designed, lb. per sq.in	250
Superheat, deg. Fahr	200
Steam temperature, deg. Fahr	601

STOKERS, Taylor Underfeed

Number of retorts per boiler	14
Effective area both stokers, sq.ft	176
Ratio grate surface to boiler heating surface	48
Floor space, boiler and stoker per 10 sq.ft. heating surface, sq.ft.	0.0700

ECONOMIZERS, Sturtevant High-Pressure Cast-Iron Vertical Staggered Tubes

Number installed	6
Heating surface, each, sq.ft	6,450

INDUCED DRAFT FANS, Sturtevant-Multivane No. 14, Design No. 3

Number installed	4
R.p.m.	350
Drive, two motors, slip-ring, chain drive, 100 hp.; 720 r.p.m.; two turbines, Sturtevant, geared.	

STACKS, Steel

Number installed	2
Diameter (in.)	108

FORCED-DRAFT FANS, Buffalo Forge Double-Turbo-Conoidal

Number installed	3
R.p.m.	1,170
Capacity at 6-in. static (cu.ft. per minute), each	79,000
Drive, two 150-hp. motors, direct-coupled, 1170 r.p.m.; one turbine, Terry-geared, 150 hp.	

FUEL AND ASH

Pittsburgh slack (average B.t.u.)	12,500
Yard storage (tons)	5,000
Method of handling	Locomotive crane
Capacity (tons)	20
Overhead suspended-steel bunkers, capacity (tons)	1,440
Coal handling equipment	Link-Belt
Capacity (tons per hour)	50
Ash elevator, motor-driven, capacity (tons)	2
Ash cars, capacity (cu.ft.)	40

FEED PUMPS, Cameron Four-Stage Centrifugal

Number installed	3
Head (ft.)	693
Gallons per minute	375
Drive, direct-coupled, two 150-hp., 1750-r.p.m. motors; 2700 r.p.m. turbine.	

FEEDWATER HEATER, Open, V-Notch Metering

Capacity (lb. water per hour)	300,000

MAKE-UP FEEDWATER PURIFIER, Sorge Hot Process

Capacity (gal. per hour)	3,600

TURBINES, Curtis Horizontal

Number installed		2
Capacity, kw. (maximum at 80 per cent. power factor)	7,500	10,000
Floor space, per kw. (sq.ft.)	0.0253	0.042

CONDENSERS, Surface-Type, Wheeler

Number installed		2
Tube surface, sq.ft	10,875	18,325
Rated capacity (lb. steam per hour)	87,500	147,500

CIRCULATING PUMPS, Centrifugal

Number installed		
Capacity, each, g.p.m.	8,000	13,500
Drives, motors and turbines, capacity, hp	60	95

AIR PUMPS, Turbo-Centrifugal

Number installed		2
Drive, motors (hp.)	55	55

CONDENSATE PUMPS, Centrifugal

Number installed		2
Drive, motors (hp.)	10	15

CIRCULATING WATER, Traveling Screens, Chain Belt

Number installed	2
Screen area, low water, each (sq.ft.)	32

HURLING-WATER SUCTION-SCREEN, Elliott Twin Type

Size (In.)	12

GENERATORS, Three-Phase, 60-Cycle 6600-Volt

EXCITERS

Steam-turbine-driven (kw.)	200
Motor-driven (kw.)	150
Direct-connected to 10,000-kw. turbine	75

BATTERY, Operating Oil Switches

Amp.-hr. on eight-hour basis	80

GENERATOR OIL SWITCHES, G. E. H-6,, 15,000 Volts, 1200 Amp.
FEEDER OIL SWITCHES, G. E. H-6, 15,000 Volts, 300 Amp.

Potential Water Power and Coal Saving

Utilization of Additional Storage Sites in New Hampshire Would Permit Generating 490,000,000 Hp.-hr. More Yearly than Is Now Produced on Connecticut and Merrimack Rivers, Saving 278,000 Tons of Coal

SOME very interesting figures on the number of unutilized storage sites available in New Hampshire and on additional power which could be developed if suitable storage was provided were presented in a recent report* of the New Hampshire Commission on Water Conservation and Water Power. According to this report about 100 sites for storage reservoirs are available in the state, which if utilized would permit developing about 345,000,000 hp.-hr. on the Connecticut River and its tributaries and 145,000,000 hp.-hr. on the Merrimack and its feeders, expressed as a yearly additional output. Excluding the Androscoggin River, it is estimated that about 278,000 tons of coal could be saved annually at the present development by suitable storage construction.

Certain data regarding the Connecticut and Merrimack Rivers are of special interest. The Connecticut River and its tributaries drain 3120 sq. miles (8100 sq.km.) in New Hampshire, or slightly less than the Merrimack basin. All the water powers on the Connecticut north of the Massachusetts line except those at Bellows Falls, Vt., fall in New Hampshire. The quantity of water available for power on the Connecticut varies greatly during the year, the river falling to a low stage during the late summer and in some years having a low stage in midsummer. More than 50 per cent of the annual flow occurs during the three spring months. Records of flow at Orford, N. H., have been taken since 1900. The driest year gave an average run-off of 1.29 sec.-ft. per square mile (0.014 cu.m. per second per sq.km.), and the wettest year an average of 2.24 sec.-ft. (0.024 cu.m.). It probably would not be practicable to secure sufficient storage to carry the water over from a "wet" year to a "dry" one. Between West Stewartstown and Vernon (the site of a 20,000-kw. plant of the New England Power Company) 226 ft. (69 m.) of fall had been developed and about 370 ft. (113 m.) remains for possible future development. Preliminary investigations indicate that there is a possibility of a total economical development of 24,500,000,000 cu.ft. (680,000,000 cu.m.) of storage, of which amount 15,000,000,000 cu.ft. (420,000,000 cu.m.) is as yet undeveloped.

According to Walter H. Sawyer, consulting and hydraulic engineer, Lewiston, Me., the total developed and undeveloped power in New Hampshire is:

	Present Conditions—		With Additional Economic Storage	
Head. Ft.	24-Hr. Hp. Low Water	24-Hr. Hp. 60% of Time	24-Hr. Hp. Low Water	24-Hr. Hp. 60% of Time
Developed 294.....	42,000	47,000	47,000	52,000
Undeveloped 268.....	37,400	44,180	44,180	48,800

In addition to the benefits to be gained by the use of stored water at power developments on the tributaries themselves, the storage shown in Table II when used at power developments on the Connecticut River above the Massachusetts-New Hampshire line (including Bellows Falls) would develop an amount of power equivalent to the use of 47,000 tons of coal annually.

The value of this storage to the power developments on the Connecticut River below the New Hampshire line would be equivalent to 50,000 tons of coal annually, making the total increase of power at developments on the Connecticut River equivalent to the use of 97,000 tons of coal a year.

The preceding estimates have not taken into consideration the possibilities for storage in connection with

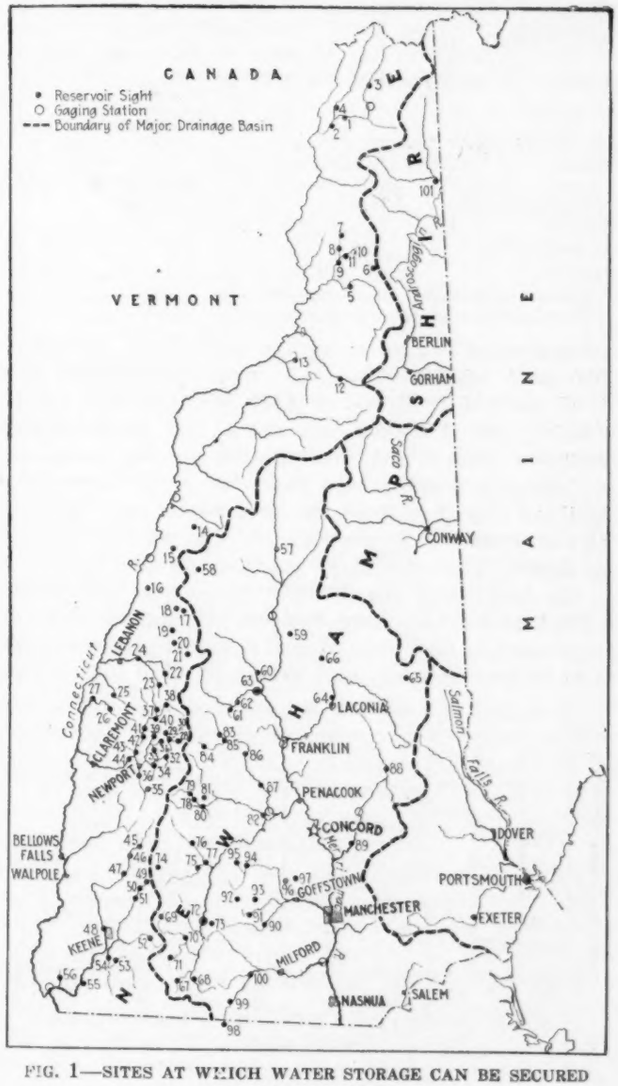


FIG. 1—SITES AT WHICH WATER STORAGE CAN BE SECURED IN NEW HAMPSHIRE

increased power developments by a dam at the head of Fifteen Mile Falls, inasmuch as the storage at that place would be economically possible only in connection with the power development.

It is estimated that the 15,000,000,000 cu.ft. (420,500,000 cu.m.) of storage in the Connecticut River basin, when developed, would involve fifty-six storage

*Field investigations and engineering estimates were in charge of C. H. Pierce, district engineer, U. S. Geological Survey, Boston. George B. Leighton is the New Hampshire Conservation Commissioner.

reservoirs and benefit local power users on tributary streams to the extent of 26,600 tons of coal yearly, power users on the Connecticut River in New Hampshire to the extent of 29,800 tons of coal annually, power users on the river outside the state, 67,200 tons annually, or a total of 117,600 tons saving.

On the Ashuelot River, with a total drainage area of 440 square miles (1140 sq.km.), it is estimated that nine storage reservoirs with a capacity of 1,846,000,000 cu.ft. (51,700,000 cu.m.) could be developed at a total cost of $315,600, or $171 per 1,000,000 cu. ft. ($6,100 per 1,000,000 cu. m.). The accompanying chart of run-off and precipitation on this basin for a four-year period ended Sept. 30, 1918, shows in a striking way that these two occurrences may be practically inversely proportional to one another instead of directly proportional, as is sometimes assumed.

TABLE I—CONNECTICUT RIVER STORAGE

Power Site	Head Developed	Head Undeveloped	Possible Additional Storage in Million Cubic Feet
	....	....	Above Beecher Falls, 2,700
West Stewartstown	11	...	
Lyman Falls	30	...	
	....	...	Ammonoosuc River, 3,300
Guildhall	13	...	
	....	...	Miscellaneous 260
Fitzdale	23	...	
Fifteen Mile Falls	....	275	
McIndoes	15*	...	
East Ryegate	14	...	
	....	50	Miscellaneous 220
Wilder	35	...	
	....	45	Mascoma River 1,550 Miscellaneous 1,120 Sugar River 4,000
Pellows Falls	52	...	
Vernon	33	...	
	....	...	Ashuelot River 1,850
Turners Falls	58	...	
Holyoke	45	...	
Windsor Locks	28†	...	

*At one time developed; dam now in ruins.
†Estimated; probably not fully developed yet.

On this basin the 1,720,000,000 cu.ft. (48,100,000 cu.m.) of storage above Swanzey, N. H., would be an equivalent of 6500 tons of coal yearly, and there would also be an equivalent coal saving of 6100 tons a year at Turners Falls, Holyoke, Mass., and Windsor Locks, Conn., or a total of 12,000 tons saved through storage on the basin of this Connecticut River tributary.

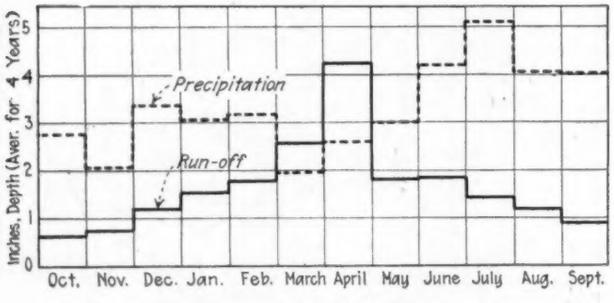


FIG. 2—PRECIPITATION AND RUN-OFF FOR ASHUELOT RIVER BASIN

MERRIMACK RIVER STORAGE

The power developments on the Merrimack River below Franklin Junction are as follows: Sewalls Falls (Concord Electric Company), 15 ft. (4.6 m.); Garvins Falls, 28 ft. (8.5 m.); Hookset dam, 14 ft. (4.3 m.) (Manchester Traction, Light & Power Company); Amoskeag dam, 55 ft. (16.8 m.). Including 30 ft. (9 m.) undeveloped from Griffin Falls to Cromwell Falls, the total is 142 ft. (43 m.), and at Lowell, Mass., 36 ft. (11 m.) are developed and at Lawrence, Mass., 32 ft. (9.8 m.). This shows that the possibility of future water-power developments on the Merrimack is small compared with the Connecticut. The greatest improvements must come through a more efficient use of the water and by storing against the spring waste. It is estimated that the coal equivalent of water wasted during three months of the average year, assuming that the plant installation is sufficient to utilize the average flow of the river, is 8500 tons at Sewalls Falls, 16,500 tons at Garvins Falls, 9500 tons at Hookset dam and 38,100 tons at Amoskeag dam, or the equivalent of about 72,600 tons at these four dams. It is estimated that the water similarly wasting at Lowell and Lawrence would represent the equivalent of an additional 69,100 tons of coal, or a total of 141,700 tons. It is probably not economically possible to save all the water now wasted during the months of high run-off, but if one-half of it can be saved, the coal equivalent would be about 70,000 tons yearly. The grand total estimated benefit from storage, including the entire year and all users, would be about 160,000 tons.

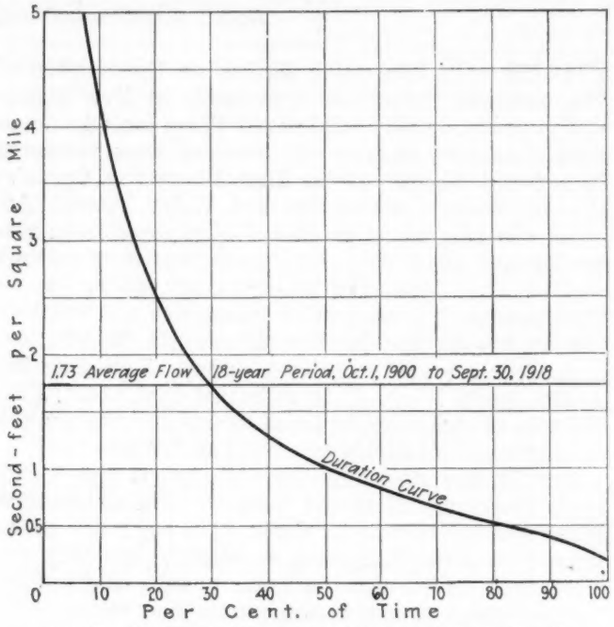


FIG. 3—DURATION CURVE FOR CONNECTICUT RIVER AT ORFORD, N. H.

TABLE II—CONNECTICUT RIVER STORAGE IN NEW HAMPSHIRE

Tributary Basin	Storage in Million Cubic Feet—Total Economically Possible	Not Yet Developed
Upper Connecticut	6,800	2,700
Upper Ammonoosuc	3,500	3,300
Miscellaneous	1,700	1,600
Mascoma	4,000	1,550
Sugar	6,000	4,000
Ashuelot	2,500	1,850
Total	24,500	15,000

Among the individual reservoir projects or storage improvements on tributaries of the Merrimack River, those proposed for Squam Lake and Lake Winnepe-

saukee are of much interest. Squam Lake is the largest body of water tributary to the Pemigewasset River. Its net water area is 14.5 sq. miles (37.6 sq.km.), which, with a draw-down of 5 ft. (1.5 m.) gives a storage capacity of about 2,000,000,000 cu.ft. (56,000,000 cu.m.). The tributary drainage area, including water surface, is 57.5 square miles (149 sq.km.), which is sufficient to warrant a considerably larger storage capacity if the reservoir could be operated so as to secure the maximum benefits from the storage. Unfortunately from this point of view, the requirements are that a continuous flow of 75 cu.ft. per second (2.1 cu.m. per second) and twenty-four hours per day, Sundays excepted, shall be released from the lake outlet. Even with this continuous draft, the lake usually fills, and in some years water overflows the dam. With a fall of 111 ft. (33.8 m.) from the top of the lake dam to the mouth of the river and the developments which have been made, it is important that a steady flow shall be maintained or else power from some other source supplied.

TABLE III—UNDEVELOPED WATER-POWERS ON CONNECTICUT RIVER

Power Site	Head	Drainage Area*	Flow in Cu.Ft. per Second 50% Time	80% Time	Available Power in Hp.-Hr.
Fifteen Mile Falls	275	1,600	1,600	800	190,520,000
Piermont	50	3,100	3,100	1,550	67,120,000
Quechee Falls	45	4,500	4,500	2,250	87,680,000
Total	370	.....	.....	.....	345,320,000

To obtain the greatest efficiency in power development on the Pemigewasset at Bristol Falls, additional storage is needed. With this the output of primary power could be materially increased. This might be accomplished without loss of power to any of the present power users by electrification of their plants so that power could be supplied from Bristol Falls during the periods when water was being stored in Squam Lake, and by the installation of generators of sufficient capacity to use the total flow when water was drawn from storage, any surplus power above that needed at the plants being absorbed in the Bristol Falls system. This would result in the total run-off from Squam Lake being used as primary power. It appears practicable to raise the lake level about 2.5 ft. (0.75 m.), thereby creating an additional storage of about 1,000,000,000 cu.ft. (28,000,000 cu.m.). In connection with a development at Bristol Falls this would represent an increase of 2,610,000 hp.-hr. to the low-water power, or the equivalent of 2600 tons of coal a year. Lake Winnepesaukee is the most important feeder of the Merrimack River. The gross drainage area at the mouth of the Winnepesaukee River is 475 square miles (1230 sq.km.). With the present allowable draft of 44 in. (112 cm.), the storage capacity is about 7,000,000,000 cu.ft. (196,000,000 cu.m.). Records of lake elevation are available to 1870, and from these it appears that water has wasted in spring in thirty-three of the forty-nine years. The average waste during the years of waste is estimated at about 2,000,000,000 cu.ft. (56,000,000 cu.m.). If additional storage capacity were available in Lake Winnepesaukee to carry over from a wet to a dry year, it is estimated that 1,000,000,000 cu.ft. (28,000,000 cu.m.) of additional storage could be realized yearly. This would represent an increase of 5,433,000 hp.-hr. yearly at the developments between the Lakeport dam and the Pemigewasset River, totaling now a 216-ft. (65.8-m.) head. The use of this storage at power developments on the Merrimack River in New Hampshire would represent an increase of 2,868,000 hp.-hr. and 1,711,000 hp.-hr. in Massachusetts. Thus a total of over 10,000,000 hp.-hr. would be realized, and it would be necessary merely to raise the level of the lake 6 in. (15.2 cm.) and possibly modify the draw-down restrictions. The construction cost for this change would be insignificant, and the equivalent coal saving would be 5500 tons on the Winnepesaukee River, 2900 tons on the Merrimack in New Hampshire and 1700 tons in Massachusetts, a total of 10,100 tons per year.

TABLE IV—UNDEVELOPED WATER POWERS ON CONNECTICUT RIVER TRIBUTARIES

Power Site	Head	Drainage Area*	Flow in Cu.Ft. per Second 50% Time	80% Time	Available Power in Hp.-Hr.
Mascoma River, Total	140	150	150 Estimated	120 Estimated	9,630,000
Sugar River:					
Claremont	145	175	160	130	10,670,000
Chandler	55	165	150	125	3,810,000
Kelleyville	150	155	140	120	9,750,000
Sugar River total	350	...	...	...	24,230,000
Ashuelot River	20	430	365	150	3,080,000
Connecticut River tributaries, total	510	...	...	...	36,940,000

* Approximate.

TABLE V—UNDEVELOPED WATER-POWERS ON MERRIMACK RIVER AND TRIBUTARIES

Power Site	Head	Drainage Area	Flow in Cu.Ft. per Second 50% Time	80% Time	Available Power in Hp.-Hr.
Moores Falls	25	2,900	2,800	1,600	30,580,000*
Bristol Falls	80	760	760	380	26,150,000†
Smith River projects	275	(75 to 85)	.....	(60 to 70)	8,550,000
Contoocook; Long Falls	108	379	500	350	24,250,000
North Branch Contoocook; Hillsboro	157	70	.....	....	14,000,000
North Branch Contoocook; Stoddard	200	35	.....	....	8,920,000
Blackwater; Potter Place	25	39	40	20	430,000
Blackwater; Webster	200	122	.....	.....	29,150,000
Souhegan; Atherton Falls	50	168	138	46	2,860,000
Total	1,120	.....	.....	.....	144,890,000

* Fall of 8 ft. in less than 0.5 mile. Maximum height of dam, 30 ft.; width of river, 400 ft.; estimated cost 10,000-hp. installation, $1,500,000.

† Dam height, 35 ft.; canal capacity, 1500 cu.ft. per second; estimated cost, 11,000-hp. installation, $1,000,000 under present conditions, January, 1919.

In the Contocook River basin, another feeder of the Merrimack, the development of 9,450,000,000 cu.ft. (260,000,000 cu.m.) of storage would represent an additional 34,100,000 hp.-hr. yearly. If used efficiently at the lower developments on the Merrimack, there would result a total saving of 43,000 tons of coal yearly in the Merrimack plants and 34,000 tons at the plants in the Contocook basin, or a total of 77,000 tons of coal, which might be considerably increased by the development of additional power at several of the storage dams.

UNDEVELOPED WATER POWERS

On that part of the Androscoggin River flowing through New Hampshire 292 ft. (89 m.) fall has been developed, giving about 41,200 hp., but there still remains 200 ft. (61 m.) of fall which might be economically developed to give about 30,000 hp.

On the Connecticut River the summary of undeveloped power in Table III applies, assuming a wheel installation sufficient to utilize a flow of 1 sec.-ft. per square mile (0.01 cu.m. per second per sq.km.) and that the flow below 1 sec.-ft. is used for 80 per cent of the time with a utilization factor of 75 per cent and an efficiency of 80 per cent.

The figures in Table III may be considered as representing primary power, and it is probable that the economic size of the wheel installations would considerably exceed a capacity of 1 sec.-ft. per square mile, thereby providing for a considerable amount of secondary power in addition to the figures which are given in the table.

There are undeveloped water powers on practically all of the Connecticut River tributaries in New Hampshire, but many of the possibilities are too small to warrant development individually unless for local use. With the present situation in regard to the use of power and the necessity of bringing power and labor together, it would seem that many of the small water powers might advantageously be developed in connection with some system of unification of hydroelectric develoments whereby the power might be economically transmitted to those localities convenient to the labor supply and the raw material.

The important rivers tributary to the Connecticut from New Hampshire on which additional power might be developed are the Mascoma, the Sugar and the Ashuelot, and among the undeveloped power sites on these rivers those that are listed in Table IV are the most important.

The opportunities for new power developments on the Merrimack River are comparatively limited, though many excellent sites are available on tributary streams. These are summarized in Table V.

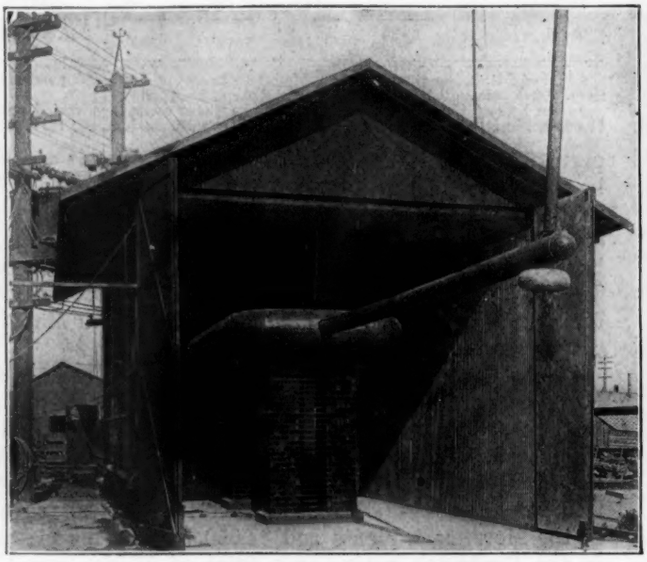
Half-Million-Volt Condenser for Testing

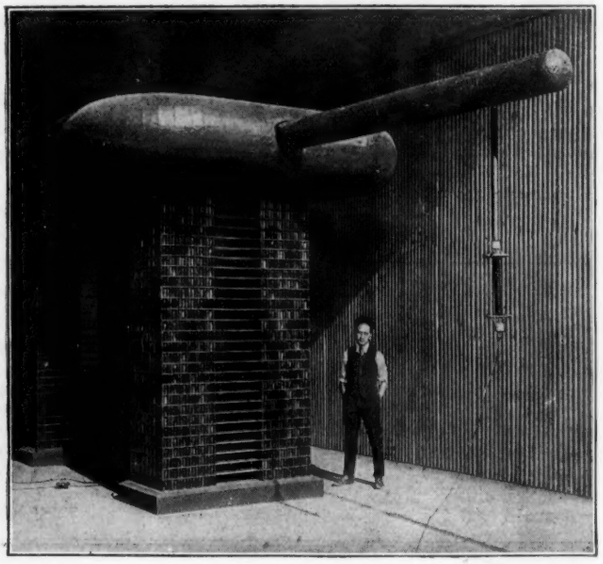
Built for Frequencies up to 60,000 Cycles and Combined with Poulsen Arc Converter and Inductance for the Purpose of Testing High-Voltage Insulators

IN ORDER to provide facilities for high-voltage tests of insulators there has been built at Palo Alto, Cal., an air condenser on which tests have been made with voltages up to 500,000 and frequencies up to 60,000 cycles, continuous oscillation. So far as is known, this is the highest voltage equipment of its type ever built.

The condenser proper is contained in a structure consisting of a wooden frame of studding and rafters lined on the inside with corrugated galvanized iron. Immediately in front of the doors a concrete paving has been laid over an area of about 20 ft. by 35 ft. (6 m. by 10.5 m.) and it is in this space that the tests are made. Under the favorable climatic conditions of this location it was not considered a disadvantage to have to make tests in the open air. On the other hand, there was distinct advantage in the ample clearances insured by having the condenser housed by itself.

The two plates of the condenser are in horizontal planes, the lower one being fixed and the upper one movable. The lower plate, shown supported inside the house, is built up of two parallel sheets of copper 2 ft. (0.6 m.) apart and connected along the edges by copper sheets curved on a 12-in. (30-m.) radius. To support the copper sheets in the shape desired a wooden form was first built up with edges carefully rounded to the desired curve, and the sheets were tacked to the wood and joints soldered. The copper plate of the condenser is supported on 9-ft. (2.7-m.) piers made up of 4-in. (10-cm.) porcelain insulators cemented together in layers, successive layers being separated by sheets of iron. These iron sheets were inserted to increase the



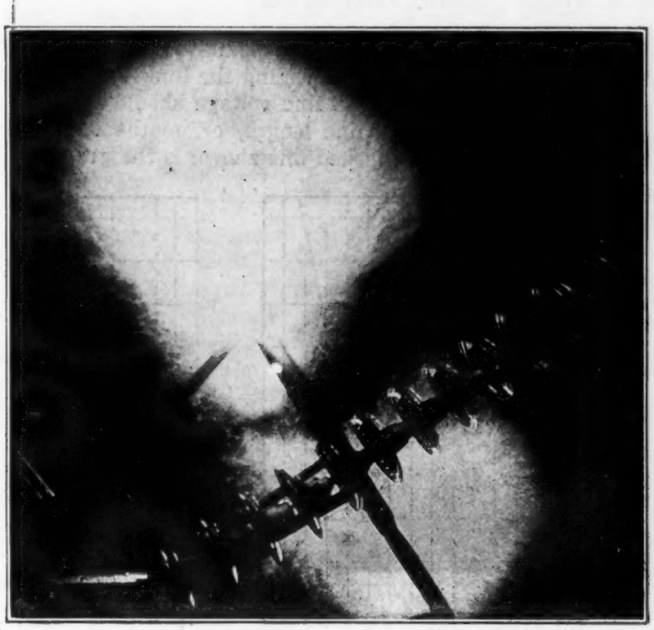


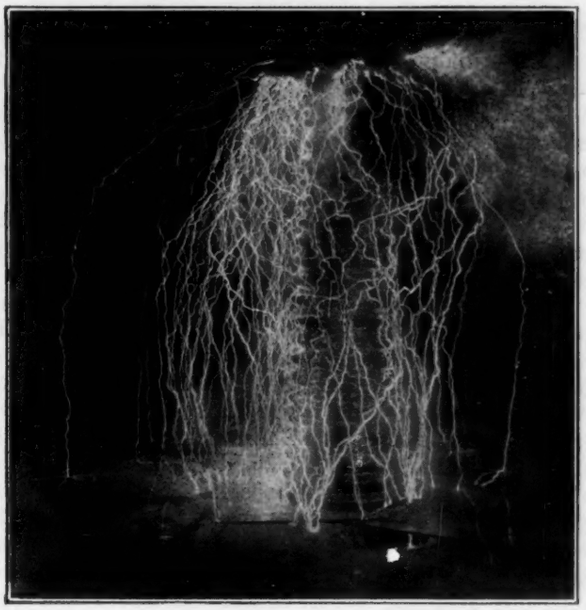
FIGS. 1 AND 2—HOUSING FOR 500,000-VOLT AIR CONDENSER; NEARBY VIEW OF LOWER PLATE, INSULATING SUPPORTS AND INDUCTANCE COIL LOCATED BETWEEN THEM

stability of the structure and are long enough to extend over the two porcelain pedestals under each end of the condenser plate, thus joining the supports so as to form two piers rather than four separate pedestals under the corners.

The upper plate, 15 ft. by 30 ft. (4.6 by 9 m.) in size, appears as the ceiling in the illustration and consists of galvanized sheet iron on a wooden frame supported on wire ropes running over the tops of the walls and can be slid in or out to secure the length desired. In fact, it has to be removed before the doors of the structure can be closed. When the "turtle neck" is not in use the aperture provided for it in the end of the condenser is closed with a curved plate to prevent corona discharge from the edges of the hole.

Tests are ordinarily conducted between the outer end of the "turtle neck" and the ground. Where an insulator is to be subjected to high-tension tests it is hung





FIGS. 3 AND 4—TESTS BEING CONDUCTED ON STRING OF INSULATORS WITH ARCING RING; DISCHARGE ACROSS POST-TYPE INSULATOR

to counterweights on the outside of the structure. By winding up the ropes on a hand-operated winch provided for the purpose the upper plate can be raised or lowered to give any desired spacing between the two plates up to a maximum of 4 ft. 5 in. (1.6 m.). The movable plate is electrically connected at all times to the galvanized lining of the house, which is carefully and thoroughly grounded.

A Poulsen arc converter of 30-kw. rating supplies energy for the tests made with the condenser. One side of the arc is grounded while the other is connected to the insulated plate of the condenser through a coil of Litzendraht, 9 ft. (2.7 m.) long and 31 in. (79 cm.) in diameter. This coil has an inductance of 21 millihenries. The coil stands upright on the concrete beneath the copper plate, and its upper end extends through a hole in the lower face of the plate. Thus, by making connection on the inside corona effect is avoided.

For convenience in testing, a projection termed the "turtle neck" has been built to extend from the copper plate some 15 ft. or 20 ft. (4.6 m. or 6 m.) beyond its end, thus permitting the arrangement of materials to be tested in the ample space on the concrete pavement in front of the housing. This "turtle neck" consists of a 10-in. (25-cm.) sheet-iron pipe made up in short sections similar to the usual method of making stovepipe. Its outer end has been rounded off with approximately the same radius as the pipe itself, and its inner end extends between the two faces of the copper plate through a hole provided for that purpose. The "turtle neck" is not permanently attached to the copper plates from a pole provided for the purpose near the entrance to the condenser house, and the upper end of the insulator is electrically connected to the "turtle neck" while the lower end is grounded. With the apparatus arranged in this way, when the arc converter is started up, any pressure up to 400,000 volts or 500,000 volts, depending upon atmospheric conditions, can be impressed upon the lower plate of the condenser, and the frequency can be regulated as desired up to about 60,000 cycles. With this arrangement the capacity of the condenser is limited by the dielectric strength of the air between the lower plate and the nearest ground. Under full potential of 500,000 volts and with the "turtle neck" withdrawn, the lower plate arcs to ground, a distance of 9 ft. (2.7 m.).

The air condenser has been designed and built by the Federal Telegraph Company, manufacturer of radio-telegraph apparatus.

COSTS must be reduced if American export trade is to be substantially increased. The first point of attack should be overhead expense which seems outrageously flagrant and extravagant with many of our American manufacturers. Unless we settle down to a new economic basis all efforts are wasted, except such product as the other fellow must buy from us, and that doesn't need salesmanship.—*William Pigott, president Seattle Car & Foundry Company.*

Analysis of Transmission-Line Construction

A Study of More than Sixty Transmission Lines Reveals the Relations Between Line Voltage and Line Length, Service Capacity, Spacing of Conductors and Tower Height

BY D. D. EWING
Professor of Electric Railway Engineering, Purdue University, Lafayette, Ind.

THE use of an existing structure as a model for the building of a new one to be used for similar purposes is not always productive of best results. Moreover, empirical curves and formulas are not always safe and true guideposts. However, studies of existing constructions may always be depended upon to yield results well worth the effort expended, and empirical curves and formulas which have successful practice for their basis are of value in making preliminary estimates and in checking final designs.

In the accompanying figures are presented some of the results of a study of the main features of modern high-tension transmission-line construction. In the course of this study data, either partial or complete, relative to more than sixty transmission lines were analyzed. Both American and foreign lines, ranging in voltage from 50 kv. to 150 kv., were included in the analysis. These data were collected from descriptions of the lines published in the various technical journals and society proceedings. Particularly valuable were the recent reports of the transmission committee of the American Institute of Electrical Engineers and the compilation of data by Selby Haar published in the ELECTRICAL WORLD for April 25, 1914.

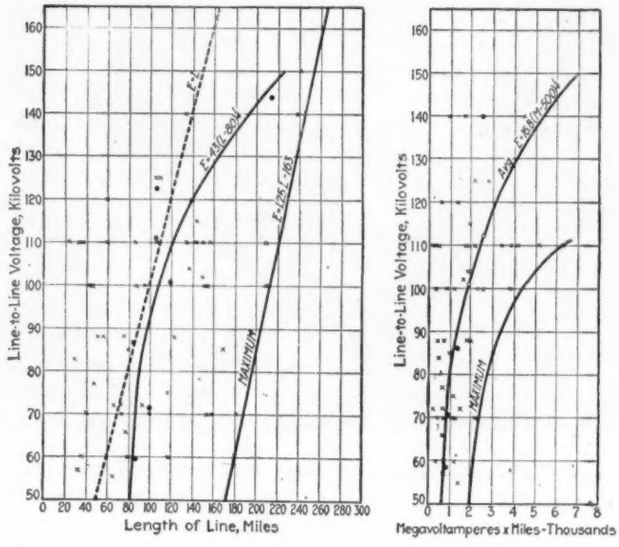
In Fig. 1, are plotted data pertaining to the relationship between line voltage and line length. The small crosses represent actual installations, and the circles are the center of gravity points of groups of the crosses. The points are badly scattered, indicating the lack of a closely defined relationship, although the general trend indicates what even the layman would probably expect, namely, the longer the line the higher the voltage required. The curved line shown is an attempt to draw a smooth line through the center of gravity points. Its equation is

$$E = 43(L - 80)^{\frac{1}{2}}$$

where E is the line-to-line voltage in kilovolts and L is the line length in miles. If the voltages above 125 kv. be disregarded, a straight line (not shown), whose equation is

$$E = 2.7L - 183,$$

represents the center of gravity points quite well. An oft-stated rule of thumb connecting the line voltage and the line length is that the line voltage should be 1000 volts for each mile of line length, or, mathematically stated, $E = L$. The dashed line shown is the graph of



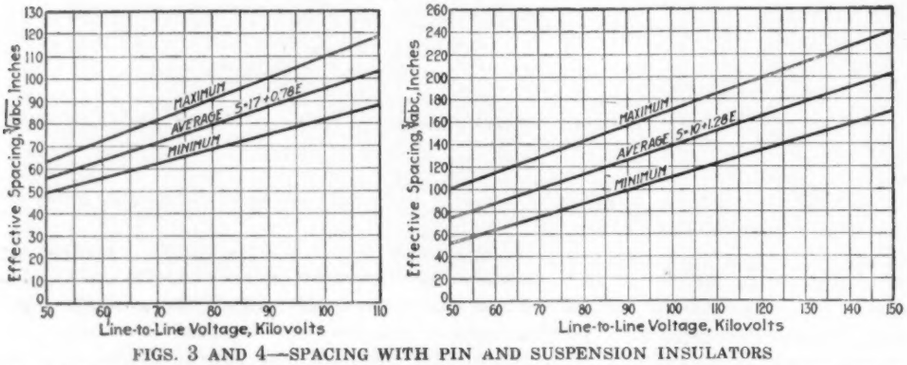
FIGS. 1 AND 2—HOW LINE VOLTAGE DEPENDS UPON LENGTH OF LINE AND LOAD

(1) Relation between line voltage and line length. (2) Relation between line voltage and the quantity megavolt-amperes times line length.

this equation. As an average it does very well except for the higher voltages. It is interesting to note that the line bounding the maxium mileage for the several voltages is straight. Its equation is

$$E = 1.25L - 163.$$

As the voltage selected for a given transmission line should be dependent on the power transmitted as well as on the length of the line, it would seem reasonable that the relationship between the voltage and a quantity which involved both line length and power transmitted would be more definite than one involving simply the line length. As will be noted in Fig. 2, this is actually the case. The quantity M is the megavolt-amperes rating of connected step-up transformers per line circuit multiplied by the length of the [illegible] This quantity is an important one, [illegible] as a transportation system for ele[illegible]



FIGS. 3 AND 4—SPACING WITH PIN AND SUSPENSION INSULATORS

(3) Relation between line voltage and effective spacing of wires for pin-type insulators, spans ranging from 450 ft. to 750 ft.; (4) for suspension insulators, spans ranging from 500 ft. to 750 ft.

well be termed a measure of the service capacity required of the line. The equation of the line that seems best to fit the center of gravity points indicated in the figure is:

$$E = 16.8(M - 500)^{\frac{1}{4}}$$

A great many factors affect the spacing of the wires of a transmission line. As many of these factors are more or less independent of the voltage, it is to be expected that considerable variation will occur in practice. The graphs in Figs. 3 and 4 show the ranges of effective spacing used for both pin-type and suspension-type insulators. In these figures maximum and minimum lines were drawn wherever the points were spread rather uniformly over a broad zone. A few scattered points in each case fell without the limitations indicated. For lines with the wires arranged other than at the apexes of an equilateral triangle the effective spacing is $\sqrt[3]{abc}$, where the several spacings are a, b and c in inches. By effective spacing is meant that spacing of triangularly arranged wires which would give the same inductance and capacity effects as the correctly transposed line with unsymmetrical wire spacing would have. For pin insulators the average spacing for the conditions noted is

$$S = 17 + 0.78\ E,$$

and for suspension insulators,

$$S = 10 + 1.28\ E.$$

DEPENDENCE OF TOWER HEIGHT ON VOLTAGE

Curves were also plotted to show how tower height depends upon voltage. The equations of the average graphs determined from these curves are as follows:

For pin insulators, triangularly arranged wires and spans of from 328 ft. to 750 ft. (98.4 m. to 225 m.) the height of the normal tower is,

$$H = 32 + 0.3\ E.$$

In the case of suspension insulators, triangularly arranged wires and spans of from 500 ft. to 800 ft. (150 m. to 240 m.),

$$H = 53 + 0.12\ E.$$

For suspension insulators, vertically arranged wires and spans of from 500 ft. to 800 ft.,

$$H = 30 + \tfrac{1}{3}\ E.$$

With suspension insulators, horizontally arranged wires and spans of from 600 ft. to 660 ft. (180 m. to 198 m.),

$$H = 35 + \tfrac{1}{10}\ E.$$

The above equations and graphs are, of course, purely empirical and as such do not permit of extrapolation; but within the limits indicated it is felt that they represent with some accuracy modern practice in high-tension transmission-line construction.

THE second Pan-American commercial conference inaugurated a new epoch in Pan-American commercial relations. Its one great outstanding characteristic has been the expression of the Pan-American or All-American idea and viewpoint, in which the interests of Latin America, just as much as those of the United States, have been frankly considered and discussed by the most eminent and skilled authorities of both North and South America. Never before has any commercial conference in the United States been so comprehensive and fair to all the countries participating.—*John Barrett.*

A 5000-KVA., 100,000-VOLT NEW-TYPE AIR-BREAK SWITCH

Designed to Interrupt Charging Current Drawn by 125 Miles of 100,000-Volt Line, It Has Broken the Current on 100-Mile Line

BY GEORGE T. SOUTHGATE

A NEW type of air-break switch has been designed by the writer and tested under the supervision of operating and factory engineers on a 100,000-volt line at Raleigh, N. C., where it was shown that the switch could consistently interrupt the charging current of 100 miles of line. As is generally known to engineers, such a current is much more difficult to break than a higher power-factor load, so that the rating of 5000 kva., which corresponds to this performance, should not be confused with the breaking capacity with a power load. The unit reached the limit

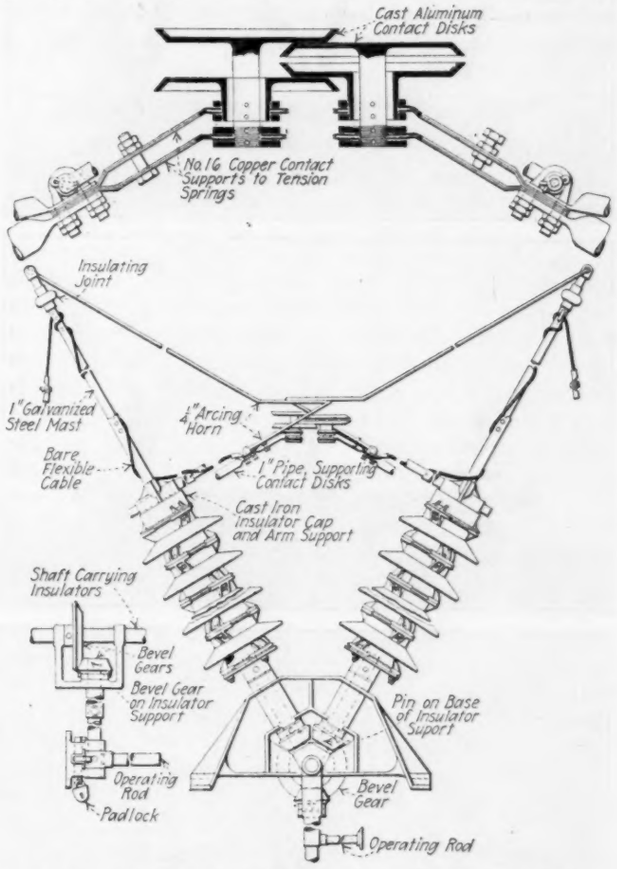


FIG. 1—DETAILS OF 110,000-VOLT AIR-BREAK SWITCH RATED AT 300 AMP.

of its successful performance with about 125 miles of 100,000-volt line connected.

Three other units are now permanently installed at an important substation for further test under operating conditions. The tests which were made were conducted with increasing currents and varying winds.

The construction of the switch is shown by the accompanying drawing, while an actual installation in the course of breaking the charging current on the line mentioned is shown at successive stages of its operation in Fig. 2, A to F. Unlike other air-break switches now available, the insulators carrying the arcing horns and contacts do not swing or pivot about their ends but rotate on their own axes. Thus the

contacts and horns do not retreat from each other through a vertical plane through the two insulators but along curved surfaces that have more of a horizontal than of a vertical direction. Their relative motions can best be understood by study of the illustrations.

While the switch is suitable for use and as a circuit breaker on light loads or wherever an oil switch would be prohibitively expensive, as at substations for small-load taps from large transmission systems, the most important service for the switch is as a mechanically operated three-phase disconnecting switch. For use between oil switches and buses or as selectors for feeders taken from double-bus systems, the switch has the following advantages:

1. The cost of manufacture is low, because the electrical parts are essentially the same as those of pole-operated knife switches and the number of insulators (the most expensive single part) is the same as in knife switches; the mechanical parts—the structure and mechanism—are simple and consist mainly of a few iron castings, pipe and bolts.

2. The switch can be used in any position on any type of structure and either indoors or outdoors. By virtue of its compact, self-contained construction of base, gears, etc., per pole, and its simple and flexible arrangement of drive between poles and from the operator's lever near the ground, a switch can be set upright or mounted sidewise or hung under a bus structure.

Throughout the complete range of voltages for which this switch is designed it is interesting to note that the parts are absolutely identical and standard equipment, with the sole and advantageous exception of the horns, masts and pipe supports for the contact wheels. These are proportional in lengths to the number of disks and heights of the insulators. Thus forty-six of the forty-nine parts required can be taken from stock to assemble any switch for 70 kv. to 140 kv. rating. Two other types of switches operating on the same principle involve in one case pin-type insulators which are of light construction for 70,000 volts and less and heavier construction than that illustrated for voltages higher than 140,000 volts.

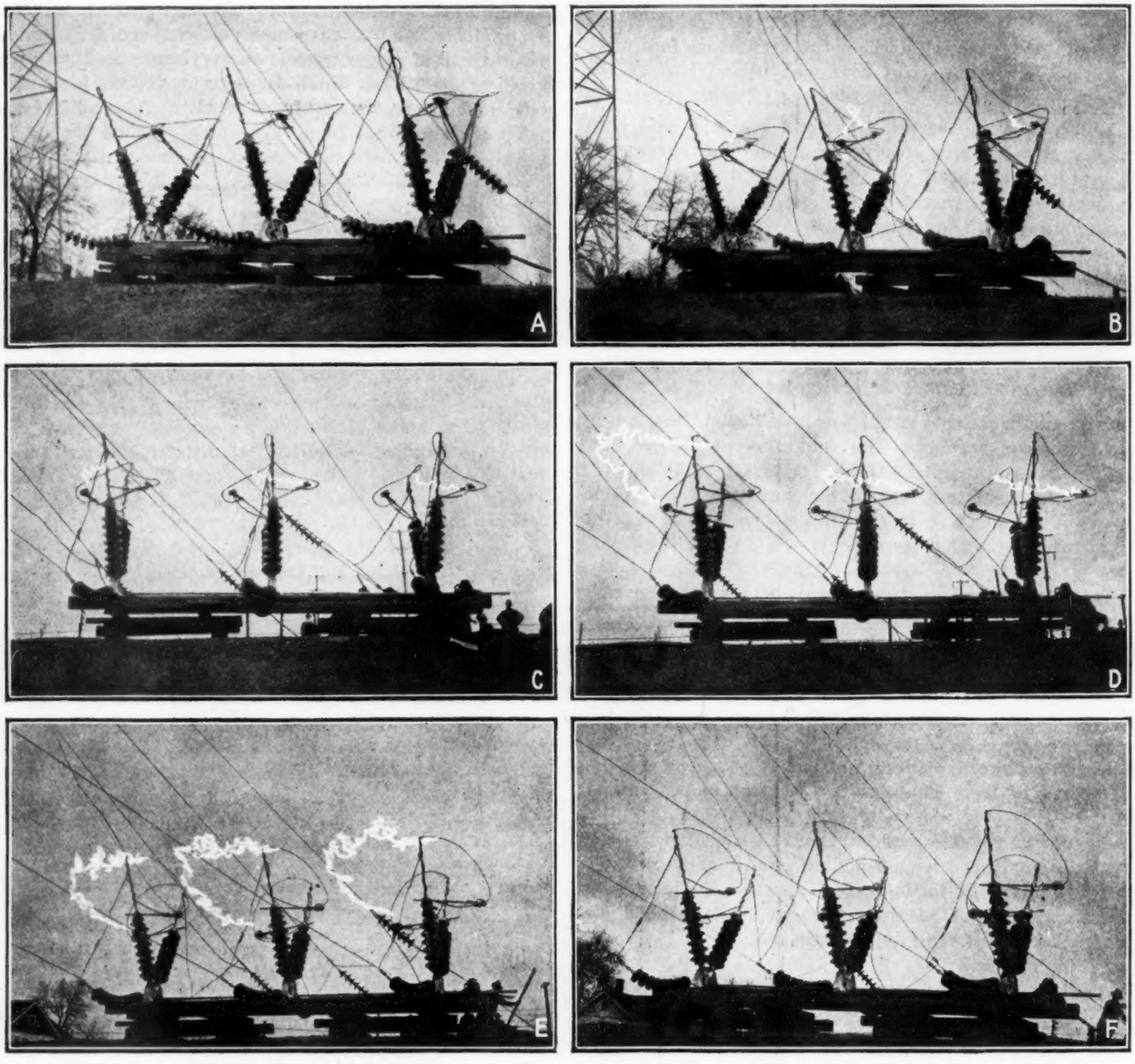


FIG. 2, A TO F—AIR-BREAK SWITCH OF NEW DESIGN IN PROCESS OF RUPTURING CHARGING CURRENT OF A 110,000-VOLT TRANSMISSION LINE 100 MILES LONG

The switch which is illustrated is rated at 110,000 volts, 300 amp. The bolt through each contact support and tension spring is for adjusting the separation of the contact disks. Because of the floating arrangement of the contact disks they make contact with each other over their entire bearing surface. The positions of the contacts and horns are adjusted by moving pipe and mast attached to these parts. The insulating joint on each mast (commonly used for insulating chandeliers from conduit) is to induce the current to flow in the right direction through the horns; that is, so the magnetic blow-out effect for stretching the arcs will be a maximum.

In opening the switch the horns are drawn apart with their convex sides facing each other. In so retreating the shortest separation between the horns is always approximately in the median plane of their closed contact. It is not at all necessary for proper contact adjustment to have the assembled insulator perfectly straight.

Rotation of the insulators carrying the horns and contact disks is accomplished by means of a bevel-gear mechanism at the base of the switch. On the lower end of each insulator support is a bevel pinion which meshes with a bevel gear, in turn driven by another bevel pinion attached to the operating rod. The bevel gear is not a complete circle but embraces an arc slightly over 120 deg. The end teeth of this sector extend sufficiently so they bear against the base of the switch when at extreme ends of its travel. Thus the stopping of opening and closing is done neither at the contacts, which would be injured by the impact, nor at the operating handle, which would allow lost motion in the mechanism to interfere with accurate closing. The gears can be inclosed.

VIEWS ON THE EUROPEAN INDUSTRIAL SITUATION

Special Commission of the National Industrial Conference Board Reports Result of Study of Conditions in Great Britain, France and Italy

The National Industrial Conference Board has published an interim report on the industrial situation in Great Britain, France and Italy by its special commismission, which visited these countries during March, April and the early part of May of this year. There was great industrial unrest in the countries visited, and investigation was made as to the primary causes of the widespread discontent. The commission accepts in its report the explanation of Sir Robert Horne of the British Ministry of Labor that the following are the chief causes of industrial unrest:

1. The long strain of the war.
2. The nervous effect produced by the extreme industrial efforts of the nation.
3. The disturbance of normal economic life.
4. The rise in the cost of living.
5. The absorption into English thinking of the revolutionary ideas from the Continent.

In the opinion of the commission the cause of most practical import is the rise in the cost of living. It is the most tangible, the most clearly realized, and bears directly upon the labor situation.

In Italy the laborers are not largely unionized. As in Great Britain, however, the radicals are very active and very outspoken. They dominate the unions and in case of disputes usually control the conservative element. "In general," says the report, "it was found in Great Britain, France and Italy that a very large percentage of the working classes were opposed to methods of force or to action against law and order. As a consequence, although advanced radicalism is proposing the general strike and nationalization, it may be safely concluded that Bolshevism is not likely to produce serious disturbance in these three countries." In Great Britain, however, the new labor organizations that have recently sprung up are controlled by radicals. The spirit behind them is a revolutionary one.

The commission reports that employers in Europe are evidently waking up to the seriousness of the situation. This is particularly true in Great Britain. They are likewise searching for methods to meet the problems that face them. British employers, the report finds, have admittedly been to blame in part for the existing discontent among their workingmen. Previous to the war they had not been sufficiently interested in the working conditions or in the general attitude of their employees.

EFFECTS OF GOVERNMENT ACTIVITY

The government also has come actively into the controversy. When employers and employees failed to reach an agreement an appeal was taken to law. The government, as a third party, frequently brought pressure to bear upon the employers to meet the demands of labor. There was offered an opportunity for ambitious politicians to secure advancement. In the opinion of the commission there are among the radicals politicians who are seeking to organize behind them the most revolutionary of the workingmen. The commission found that legislation to solve labor problems had not lessened the general discontent. It was also the opinion of the commission that a solution was not to be found in any organization.

The real solution, the commission holds, is in greater productivity. The report lays special stress on this point, urging the replacement of the erroneous economic theory of restriction of output by a cordial coöperation of labor with management. In France, where a previous shortage of labor was greatly aggravated by the losses in men due to the war, considerable evidence of such a coöperative spirit was noted. "There may be deduced from the French situation a lesson that labor's best interests are served by coöperation with management in securing the highest efficiency of production."

Contrary to some reports, the commission found that the employers were not unanimously in favor of organized labor. In conclusion, the report says: "The employer must take the lead; much in the way of leadership is expected of him. He must generally plan to prevent grievances from rising by showing a genuine interest in a fair system of remuneration, in healthful shop conditions, the proper and sanitary housing of his workers, and the welfare of the community in which his plant is located. If he is really at heart trying to raise the standard of living of his employees, he should, moreover, be occupied not only with questions of wages or material rewards but with matters which will cultivate the intelligence, morals and character of men. Granting this attitude of mind, then, there must be a corresponding point of view on the part of labor, if any permanent and peaceful adjustment is to be accomplished."

Institute Affairs Still Provoke Discussion

Dr. A. E. Kennelly Condemns Popularization Idea—William Arthur Criticises Type of Papers Now Printed—Other Comments on Development Committee Report

ADDITIONAL comments received during the past week on the changes in the activities of the American Institute of Electrical Engineers proposed by its development committee appear below. Other letters which have been received since opening the columns of the ELECTRICAL WORLD for a general discussion of the subject appeared in the Aug. 9 and Aug. 16 issues. In the latter number there was also published the report of the development committee as presented to the board of directors of the Institute on Aug. 12. At that time it was recommended in a resolution that the various parts of the report be referred to qualified committees for consideration and published in the September issue of the Institute *Proceedings* with a request to the membership that the report be carefully considered and comments upon it or additional suggestions relating to Institute activities be forwarded promptly to the secretary, when they will be referred to Institute committees and officers for further consideration.

PLAN FOR REDUCTION IN EXPENSE OF PUBLICATION

Duplication and Binding Costs Might Be Eliminated—To Seek to Popularize the Institution Literature Would Be Perilous

To the Editor of the ELECTRICAL WORLD:

SIR: I beg to bespeak a brief space in your correspondence column on the subject of "Changes in A. I. E. E. Activities," as proposed by the development committee at the Lake Placid convention, and as printed in your issues of July 5 and Aug. 2.

There can be little doubt as to the need for changes in the Institute's past publication policy, in view of the recent great increases in publication costs. All of us who naturally have the interest and prestige of the institute at heart will sympathize with the development committee in its endeavor to find suitable means for improvement and retrenchment.

It is also evident that a very large item of expense in the Institute's budget is found in the printing, binding and distribution of the *Transactions* to the members, over and above the circulation of the monthly *Proceedings*. Much of what appears in the *Transactions* has already been issued in the *Proceedings*, so that there is a large duplication of effort and expense in the present plan.

While all of us are likely to agree with the development committee in seeking a more economical publication policy for the A. I. E. E., there are various opinions as to what direction the new policy should take. One obvious plan which may have already been suggested by the committee is to cease binding the *Transactions* and leave the expense of binding to the members. In Europe it is the general rule and custom for societies to issue their *Transactions* to the members in paper covers, with various plans for enabling the members to secure uniform binding, if desired, at their own cost.

The particular suggestion of the committee which seems dangerous is the adoption of a regular engineering magazine as the channel of its official publication, with a staff of editors and advertising solicitors. It may be taken for granted that there is no present intention to lower the standard of the A. I. E. E. *Transactions*. The danger lies in the fact that, in order to meet expenses, nearly all the forces which become active in the office of such a journal are popularizing forces and make for the lowering of scientific ideals and standards. By yielding to this very natural pressure the editorial staff might easily lower the prestige of the Institute more in a few months than could be restored by a reëstablishment of higher ideals in ten years.

No one who studies the history of electrical engineering in the world can fail, it is believed, to reach the conclusion that a large share of the material and business development of American electrical engineering has been due to the high technical and scientific standard of the A. I. E. E. *Transactions*. The influence of these publications in directing and improving the training of students in electrical engineering colleges has been most noteworthy. Anything which tends to lower that standard is likely to do great harm to American professional engineering and thus to American engineering industry.

It ought to be possible to carry out the ideas of the development committee toward greater efficiency and economy in publication without resorting to imitation of magizines, which, however well these may meet the particular markets in which they sell, are likely to replace high ideals by high advertising notions.

Estes Park, Col. A. E. KENNELLY.

WHAT ARE THE IMPORTANT FUNCTIONS OF THE A. I. E. E.?

Three of Them Are Suggested, with a Critical Judgment of the Type of Papers That Has Hitherto Preponderated

To the Editor of the ELECTRICAL WORLD:

SIR: With reference to the proposed changes in A. I. E. E. activities, as outlined in the report of its development committee the writer finds occasion to comment as follows:

Among the important functions which the Institute should fulfill, I include the following:

1. Develop and maintain higher professional standards.

2. Provide its members with the latest information relating to important developments in the various branches of electrical engineering and do this in a manner easily understandable by the average electrical engineer of average technical education and training.

3. Provide ready opportunity for exchange of thought and ideas between members upon all matters affecting the interest of the profession.

In the above particulars the Institute, in the writer's

opinion, functions at not more than 50 per cent efficiency. This opinion is shared by most fellow members with whom the writer has discussed the matter, many of whom place the efficiency much lower.

The type of papers printed fails to supply the needs of members in the following particulars:

(1) They cater too much to an important but relatively small element in the profession, *i.e.*, to the designers of electrical apparatus. The rest of us—who form the majority—go hungry for needed information.

(2) Too many purely mathematical papers are provided. A sprinkling of these is necessary and desirable, but many which are published appear to have been written with no other object than to demonstrate the profundity of the author. They fail to accomplish what should have been their real object—the giving of important information to the profession as a whole.

In the writer's opinion, these highly mathematical efforts more often betray their author's limitations than otherwise. An author who feels capable of presenting a paper before the Institute should at least know his subject well enough to be able to illustrate his main points by using physical conceptions to clothe his mathematical symbols. In this way the Institute members as a whole would benefit, whereas now only a restricted specialized few do so. With what pleasure and profit one reads an Institute paper written by any of the bigger fellows—Lamme, Scott, Hobart and others. Usually it is only those lesser lights who have not sufficiently digested their own mathematical conceptions who fail in presenting properly the results of their studies.

Only recently an engineer—a man keen, alert, splendidly trained and equipped and occupying an important position with one of the big public utilities—said to me: "I have been a member for years, have paid nearly two hundred dollars in dues, but don't think I have had five dollars' worth of benefit in return." This is further than most would go, but it is symptomatic of the feeling among a large percentage of the members.

I am, however, strongly opposed to some of the recently suggested changes, particularly to those having as a purpose the extension of advertising in the pages of the Institute *Proceedings;* also to the changes in shape and size proposed for the *Proceedings*. These are steps in the wrong direction. We need to increase the usefulness of the Institute without lowering its standards. WILLIAM ARTHUR.

New Haven, Conn.

ADVERTISING IN THE A. I. E. E. "PROCEEDINGS"

Amount Should Be Sufficient Only to Make Publication Self-Sustaining—Other Proposals of Development Committee Approved

To the Editor of the ELECTRICAL WORLD:

SIR: I am in accord with the views of the committee on development as expressed in its recommendations on publication, with the exception that only sufficient advertising should be carried to defray the cost of printing and distributing the publication. I have not definitely settled in my own mind whether a change in page dimensions is necessary or desirable, but I learn toward retaining the present dimensions. I do not believe the Institute should engage in the magazine publishing business for profit, as such an enterprise is a commercial undertaking and is not a proper function of a scientific society. A small amount of advertising, just sufficient to make the publication self-sustaining, is all that should be carried. My opinion is that even if this publication as advocated by some of the committee members should show a large profit, this profit would not go to the membership but to increase the salaries of the administrative officers of the Institute, and these officers, instead of devoting all their energies to Institute affairs, might have a tendency to devote some of their energy in the direction which would mean most money to them.

The other recommendations of the proposed draft, in reference to organization activities, local federation, national council and engineering congress, are along the lines of progress to which the other national societies are aiming, and these recommendations meet with my approval. SECTION REPRESENTATIVE.

EXPANSION OF GENERAL GAS & ELECTRIC COMPANY

Acquires Pennsylvania and New England Properties Formerly Owned by Eastern Power & Light Corporation—Interconnection of P roperties

Arrangements have been made for the acquisition by the General Gas & Electric Company of the Pennsylvania and New England properties formerly owned by the Eastern Power & Light Corporation. This acquisition is a result of plans worked out by the General Gas & Electric Company interests with the various protective committees of the Eastern Power & Light Corporation. The acquired properties do not include, however, the West Virginia Traction & Electric Company, one of the former Eastern Power & Light Corporation subsidiaries.

The New England properties of the Eastern Power & Light Corporation are to be combined with certain of the properties in New England now owned by the General company, making a strong power company which will make additional water-power developments in Vermont and New Hampshire. Securities of this new company, to be known as the Vermont Hydro-Electric Corporation, have been underwritten by prominent Boston banking houses and application has been made to the State Public Service Commissions of Vermont and New Hampshire for the necessary authority to complete the organization of the company.

The General company will acquire the $3,000,000 common stock of the Metropolitan Edison Company and will acquire $3,100,000 common stock and $1,300,000 6 per cent preferred stock of the Reading Traction & Light Company. The acquisition of the common stock of the Metropolitan Edison Company, which owns all the common stock of the Pennsylvania Utilities Company, a former subsidiary of the General company, will give the General company control of an important power system in Pennsylvania with combined annual gross earnings of almost $4,000,000. The power plants at Easton and Reading are to be connected with a transmission line which will be extended also to connect with the Dover plant of the New Jersey Power & Light Company. With these extensions completed, the power system controlled by the General company will extend from just east of Harrisburg up to the system of the Public Service Corporation of New Jersey with another line extending almost as far as Philadelphia.

COOLING CONDENSING WATER HELPS GENERATING CAPACITY

Spray-Cooling Installation Reduces Condensing-Water Temperature, Increases Vacuum and Permits Carrying 5000 Kw. More Load

At the plant of the Connecticut Light & Power Company, Waterbury, the vacuum at the condensers of the turbine sets under summer conditions has been increased from 20 in. or 21 in. (51 mm. or 53 mm.) to more than 27 in. (69 mm.) by the installation of the largest spray-cooling system in New England. The plant has a rating of about 30,000 kw., but the flow of the Naugatuck River, which supplies the necessary condensing water, is so low in summer that the resulting heating of the water and the limited supply available rendered it impossible by natural means to maintain an efficient vacuum at the loads carried. These reach a maximum of about 20,000 kw. in the heated season.

By means of the spray system the discharge water is cooled under standard conditions—air at 70 deg. Fahr. (21 deg. C.) and humidity at 70 per cent with a 5 deg. Fahr. (2.7 deg. C.) terminal difference at the condenser from 110 deg. Fahr. (43 deg. C) to 85 deg. (29 deg. C.) or less. The cooling is effected by a system of discharge piping extending along the river for a distance of 918 ft. (280 m.). This system, which was designed and installed by the Spray Engineering Company, has a total capacity of 26,400 gal. (99,900 l.) per minute and consists of 280 No. 12-B bronze turbine counter-jet spray nozzles arranged in connection with twenty-eight branch pipe lines extending over the river. Each pipe line carries two five-nozzle groups, and as the length of each branch pipe line is 53 ft. (16 m.) their weight is carried by cables from twenty-eight structural steel poles 30 ft. (9 m.) high. It was necessary to place the system above extreme high-water level, and no piers or supports could be placed in the river on account of the passage of trees and logs through the stream during spring freshets.

The nozzles are carried about 15 ft. (4.6 m.) above the low-water level and 5 ft. (1.5 m.) above high water. The nozzles are fed from a pipe line which is 30 in. (7.6 m.) in diameter at a pump house, whence the water discharged from the condensers is delivered to the spray cooling system, the pipe diameter decreasing to 8-in. (20-cm.) minimum at the end furthest away from the power plant. The pumping installation consists of three 13,200-g.p.m. (50,000 l.) centrifugal pumps directly connected to 250-hp. motors, one unit being held in reserve. The pump house is located near the bridge, and a dam in the river provides a limited amount of pondage. It has been found that a saving of over 20 per cent in steam consumption is gained with the improvement in vacuum above mentioned, with resulting economy in fuel and an increase in plant output which is of great value in the manufacturing territory that is served by the public-utility company.

GUARANTEES AND RESULTS OF TESTS

The original guarantees of the system contemplated cooling 22,000 g.p.m. (83,300 l.) by mixing 4400 g.p.m. and spraying the mixture of 26,400 g.p.m., (100,000 l.), thus obtaining a certain amount of cooling due to mixing and in addition the cooling due to spraying. With 9.75-lb. (6.85-kg.) nozzle pressure and 70 per cent mean relative humidity, the system was guaranteed to reduce the water temperatures as follows:

Mean Air Temp. (Fahr.)	Temperature (Fahr.) Before Spraying	Temperature (Fahr.) After Spraying
60	104	79
65	107	82
70	110	85
75	111	86
80	113	88
85	115	90
90	117	92

In a test with the system operated on the single-spray plan only, and a mean relative humidity of 68 per cent, the following results occurred:

Mean Air Temp. (Fahr.)	Temperature (Fahr.) Before Spraying	Temperature (Fahr.) After Spraying
82	109	80
82	110	81
81	110	81
81	111	82

The mean reduction in temperature on the test was 29 deg. (16 deg. C), compared with a guaranteed mean reduction (with multiple spraying) of 25 deg. (14 deg C). At the time of the test the load was about 14,500 kw., and it would have been impossible to have carried such a load with the amount of water coming down the river without the installation of a spray system. In other words, the plant was able to carry about 5000 kw. more by this method.

Book Review

ELECTRIC RANGE HANDBOOK. New York: Society for Electrical Development, Inc. 261 pages, illustrated.

In this publication the society has gathered invaluable information in regard to the importance and usefulness of the electric range. Its large purpose, in keeping with the steady aim of the society, is to help in solving the problems of central-station managers who are seeking to develop a range load, to establish a rate for this service and to introduce merchandising methods into their business in this direction. Another object is to encourage greater activity and interest in electric ranges in general, to point the way to more extensive sales by manufacturers, jobbers and contractor-dealers, as well as to those central stations which have a cooking rate but have not actively engaged in upbuilding this business. Publication of the data will be of great help in stimulating this class of business.

Books Received

ANALYSIS OF BABBITT. By James Brakes. Troy, N. Y.: Allen Book & Printing Company. 170 pages.

THE CONSTRUCTION OF GRAPHICAL CHARTS. By John B. Peddle. New York: McGraw-Hill Book Company, Inc. 135 pages, 79 illustrations.

ELECTRICAL AIDS TO GREATER PRODUCTION. By Allen M. Perry. New York: McGraw-Hill Book Company, Inc. 332 pages, 97 illustrations.

ELECTRIC POWER TRANSMISSION. By Prof. Alfred Still. New York: McGraw-Hill Book Company, Inc. 408 pages, including appendix; illustrated.

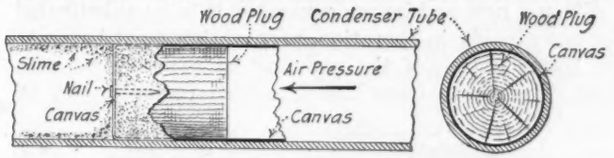
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

CONDENSER TUBES CLEANED BY MEANS OF WOODEN PLUG

When Plug Is Covered with Canvas It Can Be Easily Blown Through Tubes to Push Out Slime and Dirt

To clean condenser tubes one company used wooden plugs to which duck or canvas disks about twice the diameter of the plug are attached. These plugs, which are forced through the tubes by compressed air, clean out the slime and unhardened dirt quite effectively.



WOODEN PLUG BLOWN THROUGH TUBE CLEANS OUT SLIME AND UNHARDENED DIRT

As shown by the accompanying illustration, the canvas disk does not remain flat but folds around the plug and serves as a sort of piston packing, thus more efficiently reducing air leakage and cleaning the tubes better. To catch the plugs at the delivery end of the condenser tubes a canvas sheet is arranged as a bag.

MAGNETIC LEAKAGE CAUSES POOR TRANSFORMER REGULATION

On Opening One Secondary Circuit of a Two-Section Transformer Part of the Primary Has Choking Effect on Rest of Coil

The current in the primary of a potential transformer when the secondary is open is small, owing to the counter-electromotive force of the primary. On closing the secondary the lines of force of the secondary current tend to neutralize those of the primary, thereby increasing the counter-emf. and admitting more current to the primary; and if the primary coils and secondary coils are arranged so that all of the magnetic lines of force of one reach the other, magnetic leakage will be negligible and the secondary voltage will be maintained excepting in so far as it may be affected by voltage drop in the copper conductors.

In one case, however, where a small transformer was built with a single primary and with a two-section secondary provided with a tap so that two secondary voltages might be available, the builder found that with four lamps on each secondary leg all lamps glowed with equal brilliancy, but that on turning off the lamps of one leg those of the other immediately became dimmer. The primary was wound on one leg of the core and the secondary on the other leg, and the coils had between them considerable distance to invite leakage.

The explanation of this poor regulation due to magnetic leakage between the primary and secondary coils is as follows: On opening one of the secondaries by means of its switch the particular secondary coil involved ceased to have any neutralizing effect on the magnetism due to the primary coil, and owing to magnetic leakage between the primary and the secondary that remained closed that secondary was unable to exert sufficient neutralizing effect to maintain its own voltage. In other words, that part of the primary which became isolated owing to the corresponding part of the secondary being opened acted as a choking coil in series with the primary part that still had an active secondary coil.

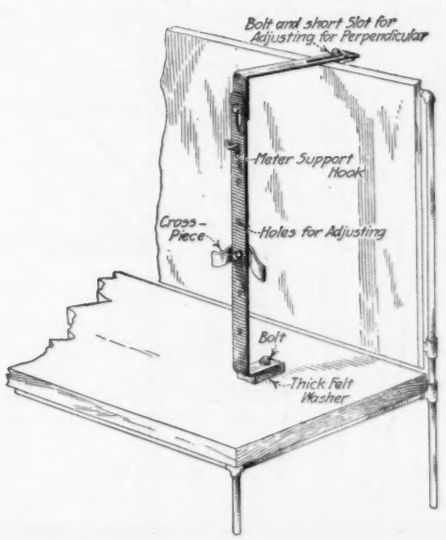
E. C. PARHAM.

Brooklyn, N. Y.

ADJUSTABLE SUPPORT FOR USE IN TESTING METERS

Made of Two Cross-Arm Braces Arranged So that the Meter Can Be Accurately Leveled—Can Be Used for Any Type Meter

Instead of hanging the meters on the test-table panel where they will be affected by vibration and be difficult to adjust, the Choctaw Power & Light Company of McAlester, Okla., has made an adjustable support which has many desirable features. The support was made from two ordinary pole cross-arm braces as shown herewith. It is attached to the table by means of a



TWO CROSS-ARM BRACES SUPPORT THE METER TO BE TESTED AND ALLOW EASY INSPECTION OF ALL PARTS

bolt through a heavy felt washer which precludes vibration. The other end is slotted and is attached to the test board so that the whole arrangement can be adjusted to make the meter hang in an absolutely vertical direction.

On the vertical cross-arm which supports the meter to

be tested are a number of holes drilled a few inches apart. These holes are for adjusting the height of the meter-supporting hook or screw. This hook is a ¼-in. (6-mm.) stove bolt lightly bent up to prevent the meter from sliding off, with a nut on either side of the cross-arm to clamp it tight. The cross-piece is bolted to the vertical piece with a short bolt and is slightly bent outward at either end so that the meter will hang against the ends. The holes for adjusting the height at which meters may be hung are provided for convenience of the tester. Some meters will require that the supporting hook and the cross-piece be further apart on the vertical piece than other types of meters. For instance, polyphase meters are much longer than single-phase meters, and the cross-piece should be one hole lower for the polyphase meters and some types of single-phase meters.

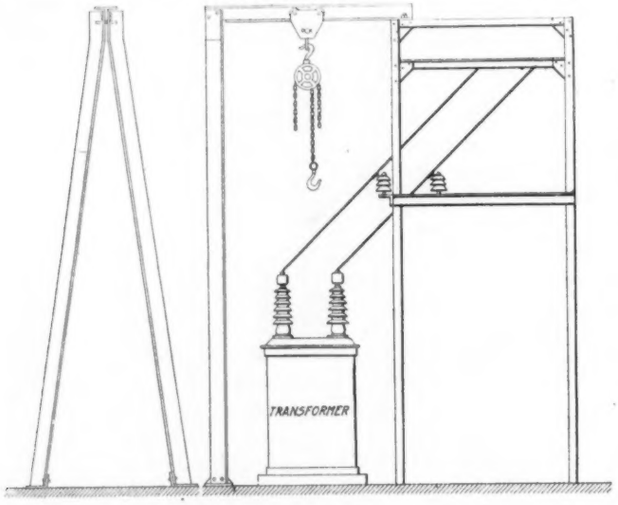
This arrangement allows all parts of the meter to be accessible to the eye. P. M. CORDELL,
Superintendent Meter Department.

McAlester, Okla.

REPAIR OF TRANSFORMERS FACILITATED IN SUBSTATIONS

Arrangement Allows Transformers to Be Set Where They Will Not Be Directly Under High-Tension Buses and Disconnecting Equipment

After transformers have been installed in the standard type of outdoor substations there is no way in which bushings, transformer top and core can be lifted from the transformer on account of the live buses immediately above the transformer. Therefore the entire substation will usually have to be shut down in case of an accident to one transformer, with the resultant inconvenience to consumers and with a loss in income during this time. In order that one transformer could be repaired while the other two were connected in open delta, the Georgia Railway & Power Company has developed a substation shown herewith in which the high-tension buses and disconnecting equipment are not directly over the transformers. The repair of transformers is facilitated because the repair crew can carry the portable outfit shown as *A*, *B*, *C* and *D* in the figure, which allows the easy removal of any part of the transformer. Moreover, there is no heavy lifting to be done by the new design of frame, and all of the steel work may be made lighter, thereby affecting a saving in first cost of the station. The portable tripods that support the chain hoist are easy to make and not expensive. All of the repair work may be done in an open field during any kind of weather by the use of a couple of heavy canvas tarpaulins, whereas heretofore this work had to be suspended until fair weather prevailed. This also applies to sending a man out to filter the oil from the transformer.



THREE-PIECE PORTABLE DEVICE CAN BE SET UP ON SUBSTATION TO FACILICATE REPAIRS

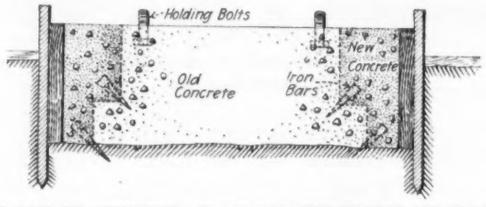
G. A. ILER.

Atlanta, Ga.

EXTENDING GENERATOR BASE FOR NEW MACHINE MOUNTING

New Generator Can Be Quickly Substituted for Old Machine if Foundation Is Prepared While Old Machine Is Still in Operation

When a new and larger generator is to be substituted for one already in operation, preparation must be made for the mounting of the new unit in the least possible time after the old machine has been removed. In all probability the concrete supporting block will have to be enlarged and new bolts will have to be placed in concrete in order to securely hold the generator in position. This can be done while the old generator is still in operation by the following means:



BASE CAN BE EXTENDED WITH OLD GENERATOR IN PLACE

Excavate around the old foundation sufficiently to accommodate the new foundation and build a form in which to pour the concrete, which should consist of a mixture of one part cement, two and one-half parts sand and five parts stone. If possible the anchoring bolts should be placed in position with wooden blocks placed over the projecting threads to prevent damaging when removing the old generator. Bolts that cannot be located prior to removal of the old generator may be placed in a drilled hole and leaded in when the machine is removed. Iron bars may be placed as shown in the illustration to hold the old and new parts of the foundation firmly together and prevent its cracking from vibration or unequal distribution of stress which may be caused by not pouring the entire foundation at the same time.

H. S. RICH.

East Berlin, Conn.

OPERATING RECORDS OF NEW CINCINNATI PLANT

Water Rate of 25,000-Kw. Turbines, 10.84 Lb. at 40 per Cent Load—Over-All Thermal Efficiency of Plant About 18 per Cent

The steam consumption of the two 25,000-kw. General Electric turbines in the new plant of the Union Gas & Electric Company, Cincinnati, Ohio, has been found to be below the guarantee on light loads. The machines

are rated at 25,000 kw. (31,250 kva.), three-phase, 60-cycle, 13,200 volts, 1800 r.p.m., and they are of the single-cylinder horizontal type with seventeen stages. Based on steam pressure at the throttle of 230 lb. per square inch (1.6 kg. per sq. cm.), 250 deg. Fahr. (139 deg. C.) superheat and back pressure in the exhaust chamber of not more than 1 in. (25 mm.) absolute, the guaranteed and tested steam consumption of these turbines under different loads were as follows:

Kw.	Lb. Steam per Kilowatt-Hour Guarantee	Test Results
10,000	.....	10.84
15,000	11.15	10.75
20,000	10.7	.....
22,000	10.6	10.6
31,000	10.8	.....

The units weigh 25 lb. (11.3 kg.) and occupy a floor space of 0.0384 sq. ft. (35.6 sq. cm.) per kilowatt of rated capacity.

The plant is equipped for burning coal and natural gas under the boilers, and the average monthly economy when burning both fuels was the equivalent of 1.37 lb. (620 gr.) of coal per kilowatt-hour generated, or 1.46 lb. (660 gr.) of coal per kilowatt-hour sent out of the station. When burning gas alone the fuel economy in equivalent pounds of coal was 1.26 lb. (570 gr.) of coal per kilowatt-hour generated or 1.32 lb. (600 gr.) of coal per kilowatt-hour sent out of the station. An over-all plant efficiency of 18 per cent to 19 per cent has been obtained based on the heat units per pound of coal as fired.

Three boiler-feed pumps, one service pump and one exciter are steam-driven, but all other auxiliaries are motor-driven. There are accordingly very few taps off the main headers with their corresponding losses.

There is no excessive amount of exhaust steam in the plant. The feed water is heated to only 110 deg. Fahr. (43 deg. C.) in feed-water heater, and the temperature is increased to 130 deg. Fahr. (54 deg. C.) in the economizer. Gases never exceed a temperature of 600 deg. Fahr. (316 deg. C.) when leaving the boiler, nor 300 deg. Fahr. (149 deg. C.) when leaving the economizer. Any additional exhaust steam which may be required is supplied from the seventeenth stage of the turbines through thermostatic control valves operated by the temperature of the feed water.

The average CO_2 values on the boilers when coal-fired is from 12 per cent to 13 per cent, and about 9.5 per cent when gas-fired. The make-up water required for the boilers averages less than 5 per cent.

SAFE TRANSFORMER RATING WHEN OIL IS REMOVED

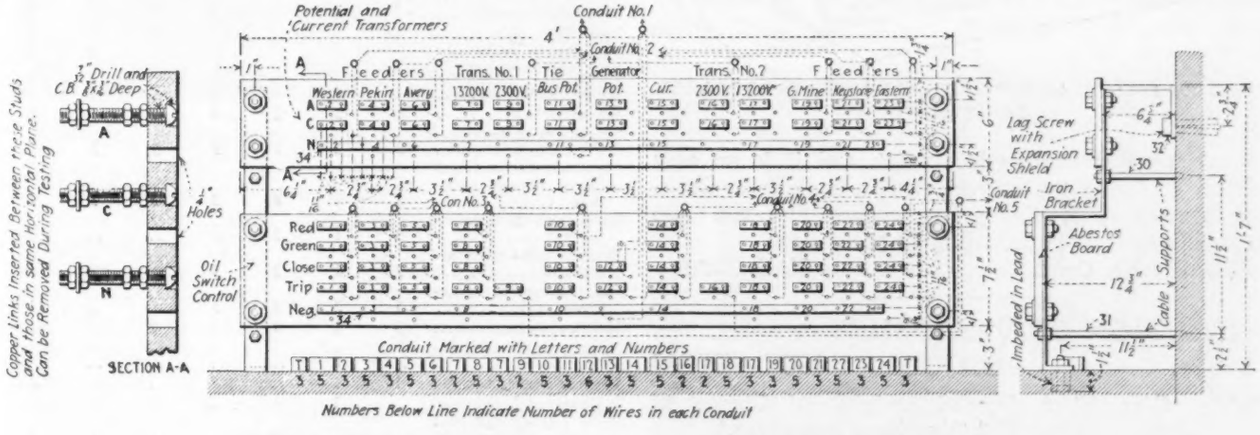
When Oil-Cooled Transformers Are Installed in Non-Fireproof Buildings Without Oil, They Can Be Operated at Only 40 per Cent of Rating

The National Electrical Code does not allow oil-filled transformers in buildings not stations or substations. The result of this is that when it is necessary to install an oil-cooled transformer in buildings not of fireproof construction the transformer will have to be of the dry type or the oil removed from the oil-cooled transformer. In the latter case the load on the transformer will have to be reduced or a larger transformer installed. The reduction output necessary to run the transformer at the same heating is about 40 per cent for transformers up to 10-kva. output. Thus a 5-kva. transformer of the oil-cooled type can be used as a 3-kva. dry-type transformer. H. E. WEIGHTMAN,
Chief Engineer Engineering Service Company.

SUBSTANTIAL TERMINAL BOARD FACILITATES METER TESTING

Cross-Connecting Instrument Leads Simplify the Work of Making Changes and Opening Circuits for Test Purposes

In order to eliminate the trouble that ordinarily comes from making changes in power-house electrical instrument circuits for testing or other purposes, the Central Illinois Light Company, Peoria, Ill., has installed a terminal board which is made of asbestos board mounted on iron brackets. The board is installed in the substation adjacent to the plant, where the energy is stepped up for outgoing high-tension lines and feeders. The connectors, which are the particular features of the board, consist of removable copper links held between lock nuts on brass machine screws. Cross-connected terminal leads are arranged so that an ammeter, for instance, can be inserted in an operating circuit before the circuit is opened and current begins to flow through the meter.



TEST LEADS CAN BE CONNECTED TO THE CIRCUITS WITHOUT OPENING THEM

Correction

The indoor substation described on page 248 of the Aug. 2 issue of the ELECTRICAL WORLD was designed by Hugh Triplett, electrical engineer, and the equipment was built by the Delta-Star Electric Company.

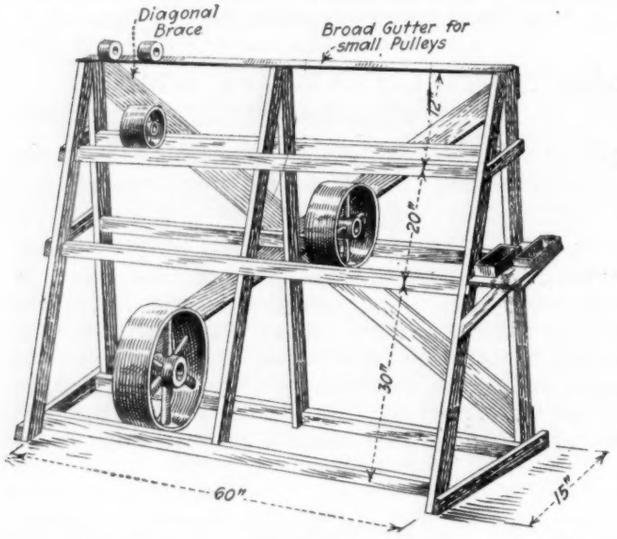
INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

WOODEN RACK FOR KEEPING PULLEYS IN INDUSTRIAL PLANT

It Is Easily Made in Shop and Allows the Quick Finding of the Proper Size of Pulley as It Is Needed

A wooden rack that can be cheaply and easily made in the shop has been found to be an ideal method for storing pulleys not in use. When the pulleys are placed in the rack, their diameter, bore and face sizes are



RACK FOR PULLEYS ALLOWS THE SIZE WANTED TO BE LOCATED IMMEDIATELY

painted on them with white paint, and it is an easy matter to locate the correct size immediately. Bushings are tied to the pulley spokes and are also kept in small boxes according to their size.

East Berlin, Conn. H. S. RICH.

SELECTION OF VARNISHES FOR COIL INSULATION

Tables Give First, Second and Third Choice of Materials That Will Give Best Assortment of Desired Qualities

Because the desirable characteristics for a perfect varnish cannot be combined into one compound, a number of varnishes have been developed, each having its own characteristic. Of course these varnishes can be used for other work than that for which they are intended, but the best results cannot be obtained. The purposes of some insulating varnishes of the Sherwin-Williams company are indicated in the accompanying table. Where more than one varnish can be successfully used the different types are indicated as first, second and third choices.

All of the varnishes mentioned in the table are of the baking type. However, insulating varnishes in general may be divided into several general classes, such as clear varnishes, black varnishes, baking varnishes and air-drying varnishes. The most marked difference between the clear and the black varnishes of course is the color, but owing to fundamental differences in the characteristics of the ingredients entering into their composition, there are also some differences in the physical properties of the varnishes themselves. As a general rule clear varnishes possess greater mechanical strength and resist oil better than black varnishes. An exception to this is the black elastic baking varnish shown in the table. Where extreme mechanical strength is required, as on small high-speed armatures, clear varnishes are almost always used.

Black varnishes are not quite so strong mechanically as clear varnishes but are sufficiently strong for most purposes. On stationary windings, as on alternating-current stator windings, the varnish is not subjected to centrifugal stresses and there is no advantage in using a clear varnish. Certain black varnishes are made from plastic materials and have the ability to withstand long-continued heating without hardening. Black varnishes

INDICATION OF CORRECT VARNISH TO USE FOR INSULATING

Characteristics of Clear and Black Baking Insulating Varnishes and Uses for Which They Are Recommended *	Clear Varnishes — Clear Baking	Clear Quick Baking	Clear Elastic Baking	Black Varnishes — Black Quick Baking	High-Heat-Resisting Baking	Black Plastic Baking	Black Elastic Baking
Dielectric strength	3	1	1	3	2	2	1
Mechanical strength	3	1	2	3	4	5	2
Flexibility	3	2	1	3	3	2	1
Plasticity	..	..	..	..	.	1	..
Oil resistance	2	1	1	2	3	4	1
Water resistance	2	2	1	2	2	1	1
Life under heat	4	3	2	4	2	1	2
Treating cloth, paper and thin fibrous materials	3	2	1	3	3	2	1
Treating fullerboard and heavy fibrous materials	2	1	2	2	3	3	2
Small high-speed armatures	3	1	2	3	..	..	2
Intermediate-speed armatures	3	1	2	3	3	3	2
Large low-speed armatures	3	2	1	3	2	2	1
Field and stator coils	3	2	1	3	2	1	1
Automobile-starting motors	..	1	..	..	..	..	..
Vacuum-cleaner motors	1	1	..	1	..	..	..
Washing-machine motors	..	1	1	..	1	1	1
Street railway and electric locomotive motors	..	..	2	..	..	1	2
Fan motors	3	1	2	3	2	..	2
Magnetos and induction coils	..	1	2	..	..	..	2
High-potential apparatus	..	1	2	..	..	..	2
Transformers	..	1	2	..	.	.	2
Average repair shop conditions	..	2	..	..	2	1	..

* Numbers indicate order of suitability.

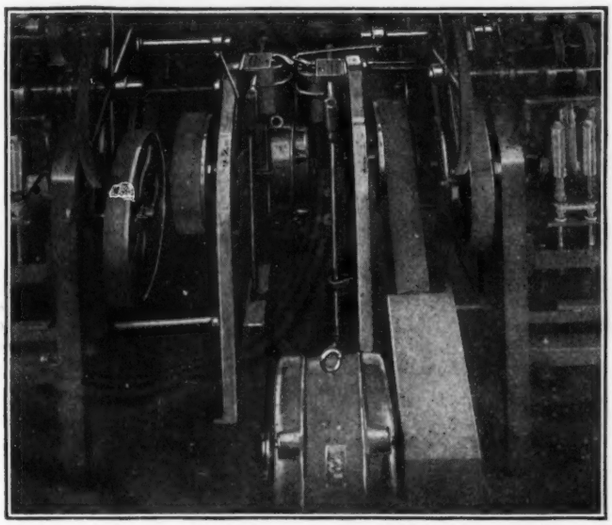
as a rule are cheaper than clear varnishes and are more commonly used for that reason.

The chief difference between baking varnishes and air-drying varnishes is in the proportion of oxidizing ingredients contained. The baking varnishes are tougher, more elastic, more resistant to oil and water, and have longer life under heat. Speed in drying is always accomplished at the expense of these characteristics, and the air-drying varnishes are less durable and elastic than the baking varnishes.

USE OF SHAFT CONTROL FOR TEXTILE MACHINE MOTORS

Rod Extending Full Length of Machine Operates Motor-Starting Switch on Individually Driven Machine

The chief advantage of having industrial-plant machines directly driven by motors are flexibility and ease of control. Flexibility is automatically obtained by individual drive because any machine can be operated at any time. An example of ease of control is shown herewith in a view of one of the rooms of the Rex Spinning Company of Ranlo, N. C. Each Westinghouse motor is fed from a pull-out box attached to the floor, a conduit running from the box to the motor starter. The motor-starter lever is operated by means of a rod attached to a dog on a horizontal shaft. The movement of the shaft starts and stops the motor. When the iron rod is disconnected from the switch the motor cannot operate.



MOVEMENT OF THE SHAFT STARTS AND STOPS THE MOTOR

TROUBLE WITH GENERATOR IN CHARGING BATTERIES

Cause of Generator Voltage Becoming Lower than Battery Voltage When Load Was Decreased Traced to Its Source

A motor-generator set used for charging electric vehicles in a plant had been giving trouble because of the charging current while carrying its load. The motor was a three-phase, 25-cycle squirrel-cage industion type, and the generator was a compound-wound 110-volt, 600-amp. machine. It was assumed that the trouble was due to incorrect brush setting or the shunt across the series fields being of the wrong resistance. In order to have the machine under working conditions when it was inspected by the troubleman it was operated several hours at full load so that the temperatures would be at the maximum when the test was made. Without changing the field resistanec the load, which was 485 amp. at 110 volts, was cut off and the voltage dropped to 85. This showed that the generator was overcompounded.

The explanation of what happened is as follows: As the load had been put on the rheostat and been adjusted so as to hold the voltage down and as the batteries became charged their voltage increased, causing their current input to decrease. This in turn caused the total generator load to decrease and its voltage to drop until a point was reached which was less than the battery voltage of 106 volts. When this happened a current passed through the series field in the wrong direction, greatly reducing the generator voltage. To bring the voltage back to the proper potential the armature circuit was opened and one of the batteries used to excite the shunt fields.

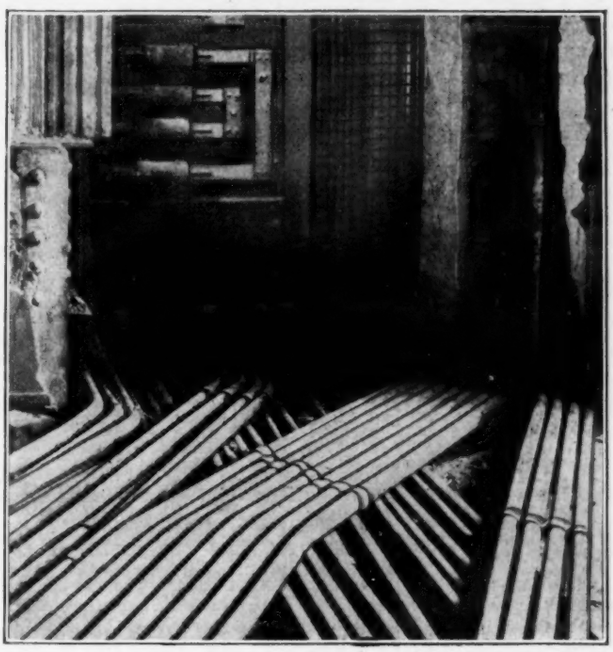
To overcome this condition the resistance of the shunt across the series field was decreased. After several trials virtually a flat working characteristic curve was obtained for the working range of the generator.

Washington, D. C. R. L. HERVEY.

CENTRALIZING CIRCUITS IN AN OFFICE BUILDING

Lighting and Signaling Circuits Are Brought to One Location to Promote Safety and Allow Easy Maintenance

The centralization of feeder circuits, while it sometimes causes congestion, has the advantage of easy maintenance and repair. When trouble occurs anywhere on the floor the repairman can immediately go to the point at which the distribution line taps to the feeder circuits. In addition, the exposed circuits can



NEARLY EIGHTY CONDUIT LINES LEAVE THIS COMPARTMENT

be placed in a compartment to which only the building electrician has access. The accompanying illustration shows how this plan was carried out in an office building in which a new floor was added. The feeder circuits consist of strap-copper risers in a shaft which are tapped at each floor by short copper buses running from the feeders to the back of the panelboard.

For this floor there are forty-four conduit lines serving the lighting and dictaphone system. On one side of the compartment are the distributers for the interoffice telephone, and on the other side the panel for the city telephone system is installed. About eighty conduit lines are directed from this location, all being embedded in concrete flooring after being laid as shown.

EFFECTIVE ILLUMINATION UPON STEAMSHIP PIERS

Good Lighting Will Increase Speed at Which Truckers Can Proceed Around Piers and Will Facilitate the Reading of Labels

Good lighting is an aid to quick loading on steamship piers because it both facilitates greater actual speed of trucking and allows the markings on boxes to be more easily read. Some steamship piers have not been equipped with proper lighting units because no actual close reading is done on them. An investigation of the lighting system of fifty-eight large steamship piers in New York City revealed that in general the standards of illumination were far too low for the most economical operation. Not only is insufficient light furnished, but in a great majority of cases antiquated equipment is employed. Obsolete types of incandescent lamps and inefficient carbon arc lamps are more prevalent than in almost any other field. Even where efficient lamps are employed, frequently light is wasted through the absence of proper reflectors. In many cases where reflectors are installed they have not been well maintained, becoming very dirty, rusted and in some cases actually falling apart. Incandescent lamps are allowed to burn after becoming badly blackened.

An analysis of results shows that 6.2 per cent had good illumination, 51.2 per cent fair illumination and 42.6 per cent illumination which was entirely inadequate and generally poor. The average watts per square foot of those piers electrically lighted was 0.16, with a maximum of 0.34 and a minimum of 0.05. The results of some of these installations are given in the table.

ILLUMINATION DATA ON STEAMSHIP PIERS*

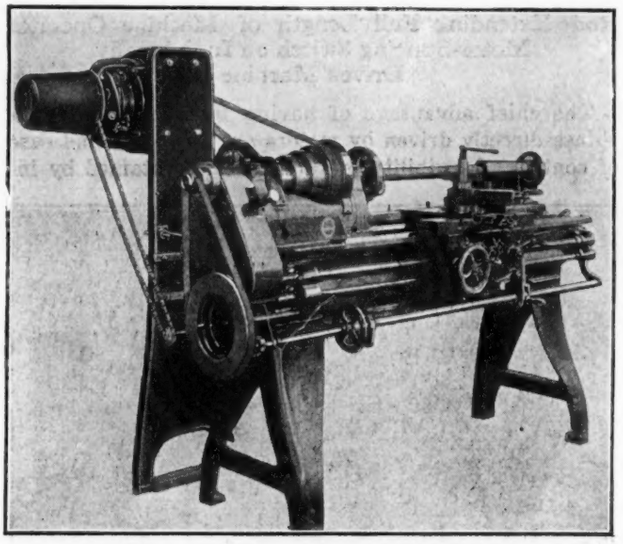
Size Lamps	Hanging Height	Spacing	Watts per Sq.Ft.	Color		Reflector	Remarks
				Ceiling	Walls		
100-watt, four light clusters	Feet 15	40 x 50	0.20	Dark	Dark	Dome	Spacing too wide for hanging height. Inefficient lighting units. Illumination results fairs.
250-watt	18	50 x 50	0.10	Light	Dark	Dome	Spacing too wide for hanging height. Results generally poor.
250-watt	15	30 x 40	0.20	Dark	Dark	Radial wave	Lighting results good.
400-watt	14	50 x 100	0.08	Dark	Dark	Dome	Spacing too wide for hanging height. Wattage too low. Results poor.
100 and 150-watt	15	30 x 30	0.16	Dark	Dark	Dome	Conditions generally fair.
250-watt	20	Irregular	0.07	Light	Light	Dome	Spacing too wide for hanging height. Wattage too low. Results poor.
100 and 200-watt	18	Various	0.09	Dark	Dark	Dome	Results poor.
100 and 200-watt	20	20 x 35	0.18	Light	Light	Dome	Illumination generally satisfactory.
400-watt	25	80	0.06	White	Dark	Dome	Spacing too wide for hanging height. Wattage too low. Results fair.
400-watt	15	50	0.16	White	Dark	Dome	Spacing too wide for hanging height. Wattage fair. Results fair.
100-watt	15	Various	0.04	Dark	Dark	Dome	Entire system poor.
100-watt, four-light clusters	15	30 x 60	0.22	Dark	Dark	Dome	Results fair, but spacing too wide.
150-watt	18	30 x 60	0.08	Light	Dark	Dome	Spacing too wide for hanging height. Wattage too low. Results poor.
100-watt, four-light clusters	25	40 x 78	0.13	Light	Light	Dome	Inefficient lighting unit. Spacing satisfactory. Lighting results fair.
250-watt	20	70 x 50	0.07	Dark	Dark	None	Conditions very bad.

*Excerpt from a paper presented by A. L. Powell and R. E. Harrington before the New York Section of the I. E. S.

SINGLE-PHASE MOTOR FOR ADJUSTABLE-SPEED DRIVE

Speed of Motor Can Be Adjusted to Predetermined Value Where Speed Will Remain Practically Constant Irrespective of Load

One method of adjusting the speed of small machine tools where only alternating current is available is to use a series-compensated single-phase motor equipped with a centrifugal governor by which the variable-speed motor is changed. In this way the speed of a 1.5-hp., 600-1800 r.p.m. Kimble motor operating a 14-in. (35.5-cm.) lathe, shown herewith, can be adjusted to any value between the minimum and maximum speeds by turning the handwheel on the left side of the shaft running across the front of the lathe. This regulates the centrifugal governor which is inclosed by the housing at the left-hand extremity of the motor. A lever may be used to operate the centrifugal governor if this is preferred by the lathe operator. One of the advantages claimed for this type of motor as applied to machine-tool applications is that once the speed has been adjusted it will remain constant, except for a slip of possibly 5 per cent, irrespective of load changes.



SPEED OF MOTOR CONTROLLED BY HAND-WHEEL ON LEFT AT FRONT OF LATHE

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

LESSENED PURCHASING POWER OF PUBLIC UTILITY EARNINGS

Under Changed Economic Conditions Should Public Utility Valuations and Returns Be Increased Over the Pre-War Basis?

BY W. H. WINSLOW
Superior, Wisconsin

The Wisconsin Supreme Court uses the following language in the case of the Oshkosh Water Works Company versus the Wisconsin Railroad Commission (152 N. W., 859): "On the other hand, if the original investment was prudent and values have enhanced, the utility should reap the benefit thereof both in rates and selling price" (of plant).

Of similar import are the following:

"Original cost is urged as a criterion of value by certain economists and state officials. The theory is that the return in money, which is the inducement and the reward for serving the community with water or gas or other service, is justly to be determined on the basis of the amount of sacrifice on the part of the investor; and this amount of sacrifice is summarily identified with the original investment in existing property. The assumption neglects to take account of the fact that there would ordinarily be successive owners of the property or of shares in it and at different purchase prices. Furthermore, the test proposed applies to property devoted to the public use the socialistic basis for fixing value, while the property of all other persons in the community is valued in accordance with the non-socialistic basis of our economic structure without reference to its cost. Money, the measure of value, changes in purchasing power in obedience to economic law." (From the report of H. M. Wright, master in chancery, in the case of the Spring Valley Water Company vs. City and County of San Francisco in District Court of the United States, Northern District of California, Second Division.)

"With reference to contentions such as those set forth in Whitten, 'Valuation of Public Service Corporations,' Chap. 5, that the actual cost of the property should be considered, it may be pointed out in addition that the original value of the property is not shown by showing the number of dollars which the property must have cost originally. The dollar is not a fixed standard of value. Its purchasing power varies. And so it would be unfair to say that because a property cost a thousand dollars seventy-five years ago a thousand dollars of to-day adequately represents the amount of the investment." (From "Validity of Rate Regulation," by Robert E. Reeder.)

Apparent Earnings and Real Ones

Consider these statements in reference to rates: Suppose a utility to be valued in 1914 at $1,000,000 and a fair rate of return fixed at 8 per cent; the allowable net earnings would then be $80,000. Suppose, further, the same utility to be valued four years later at $2,000,000 owing to the great enhancement in labor and material values; at the same rate of return the allowable net earnings would be double the former figure, or $160,000. It would thus appear that through no effort on the part of the owners of the property their earnings had greatly increased. But is this true? It should be kept in mind that money is intrinsically valueless; that is to say, in itself it supplies no human want or need and its only real value comes from its exchangeability for useful commodities. Viewed in this light, it is doubtful whether the owners of the hypothetical plant above referred to have had any real increase in earnings, though the nominal earnings have doubled.

For example, the amount of cotton that could have been been bought for $80,000 in 1914 would have cost $239,200 in 1918, the pig iron that could have been bought for $80,000 in 1914 would have cost $193,600 in 1918. These computations are based on the New York *Annalist's* average prices for 1914 and 1918.

The Rising Cost of Food

The same thing holds good for foods: Taking the *Annalist's* composite cost of foods, we find that the same quantity of food that could have been bought for $80,000 in 1914 would have cost $159,280 in 1918.

It is, of course, true that it would be impracticable to have rates constantly fluctuating up and down with changes in plant costs, but, if present conditions are to continue for some time even in a somewhat modified form—that is to say, if we are entering on a period during which the purchasing power of a dollar is going to be materially less than was the case for many years preceding the world war—it is most certainly true that utilities are entitled to have their return figured on a sum which reflects the greatly increased values of labor and material. The justice of this becomes even more apparent when we consider the matter from the standpoint of the individual stockholder. Thousands of people are feeling the pinch of poverty who had thought their old age comfortably provided for, because when they come to translate their nominally unchanged dividend checks into food and clothing they find that their real income has diminished one-half or more.

If a utility were to say to its employees, "You will have to get along now on the same wages that we paid you in 1914," it would be held up to public execration, and quite justly; and yet something very much like this is what they are saying to their stockholders when they are not obliged to tell them that even the old wages of their investment have been reduced. It seems to be quite generally believed by those most competent to judge that wages and commodity prices will remain for a long time on a much higher plane than that prevailing prior to the war, and it would seem therefore as though the utilities could appeal with justice and

right on their side for a re-appraisal of their properties which would enable them to make earnings whose purchasing power would at least approach that of five years ago.

[The suggestions outlined by Mr. Winslow were first advanced by him prior to the presentation of the well-known views of Prof. Irving Fisher of Yale University at the conference of governors and mayors at the White House on March 3 to 5, 1919. Professor Fisher corroborated the opinion of Mr. Winslow that we are entering a long period of high prices. Professor Fisher said, in part:

"Business men should face the facts. To talk reverently of 1913-14 prices is to speak a dead language to-day. The buyers of the country, since the armistice, have made an unexampled attack upon prices through their waiting attitude, and yet price recessions have been insignificant. The reason is that we are on a new high-price level, which will be found a stubborn reality. Business men are going to find out that the clever man is not the man who waits, but the one who finds out the new price facts and acts accordingly."]

ACTIVITY RENEWED IN FARM-LINE TRANSMISSION

Central Stations Favor Use of Lower-Voltage Lines Costing $600 to $800 a Mile and See Necessity for Charging from $5 a Month Upward

There probably never was a time when transmission-line construction was more active in the Middle West than it is now. Central stations are building lines as rapidly as possible and are planning more. In general the construction is of two sorts for two very different purposes. The first consists mainly of 33,000-volt and 66,000-volt lines interconnecting generating stations and taking on new towns or industries. The second consists of 2300-volt and 4600-volt lines designed to serve groups of farmers and small villages. More of these lower-voltage lines are being built as central-station men see the manifest disadvantages of tapping important high-voltage lines to take on small customers. While it is difficult to generalize on prices when the metal markets are so unstable, it may be said that farm lines cost at present from $600 to $800 a mile and the 33,000-volt and 66,000-volt lines cost from $3,500 to $4,500 a mile. Moreover, the cost factor seems at present to be one of the most important items in determining how long this era of construction may last. Certainly the demand for service will not limit the activity for some time to come, especially in the farm-line extensions. In this department of the business it seems unlikely that even high prices can curtail construction because the farmers who pay for the lines are prepared to disregard cost.

In no case do central stations apparently consider it good practice to let the farmers build their own lines unless the construction follows specifications drawn by the central station. Central-station specifications on these small lines vary materially, but the average construction employs cedar poles 3 ft. (9 m.) high with 6-in. (15-cm.) tops spaced thirty to the mile. Wooden cross-arms are favored, and some companies are showing a preference for steel-cored aluminum wire on account of its lower first cost.

When the farmers do build these lines and turn them over to the central stations the usual practice in the accounting department is not to write the lines on the books as an investment, but an account is opened for taking care of maintenance which is properly chargeable against the line. This is charged against operation.

A particularly interesting thing about this transmission-line business is that it is not confined entirely to the companies that might be called large financially. Companies that many men even inside the industry have never heard of are building from 50 miles (80 km.) to 75 miles (120 km.) of line. This is due partly to the insistent character of the demand and partly to the fact that a few wide-awake jobbers have trained men at work in the field. These men are sales engineers who not only take the order for all of the line materials but also do a complete engineering job on the line. This service is, of course, appreciated by the smaller companies which cannot maintain an engineering staff large enough to handle such work.

Studies of the loads which come on these farm lines are also being made by some companies. One of the principal facts so far obtained is that the diversity between individual customers' loads is not so great as it is in town, largely for the reason that nearly all families work on about the same schedule. Electric cooking, for instance, is said to show peaks twice as great as the same equipment would produce if operated in city homes. Further investigation of this phase of the business is needed for use in rate making, as are also authentic data on farm-line losses. In the meantime it seems to be generally conceded that at least a $5 month minimum charge is necessary to make the farmer a paying customer.

The work that is being done in farm-line construction is undoubtedly commanding more interest among central stations than the work on the 33,000-volt and 66,000-volt lines. This is because it is in the nature of pioneering. However, some lines that are important from the standpoint of engineering and economical operation are being built or planned, and on these lines it will be interesting to watch construction costs to see how the war has changed line values. It is probable that no matter how high the costs may go the expenditure will be justified, because with coal at present prices there are numbers of small plants in the Middle West where the cost of coal alone amounts to from 2.5 cents to 5 cents per kilowatt-hour.

LARGE INCREASES IN ELECTRIC POWER LOAD

Public Service Company of Northern Illinois Adds 14,900 Hp. in First Half of 1919, a Substantial Gain

The rapid increase in electric power business of the Public Service Company of Northern Illinois under present conditions is shown by some details of the new load taken under contract. Between May 31 and July 5 the addition made to the contracted load was over 4500 hp. The total allotment for the year 1919, including all divisions, was figured out at 17,000 hp. The total contracted power load for the year to July 5 was 14,937 hp., or, roughly, 2200 hp. less than the allotment with six months of the period remaining. In this total sixty-two electric ranges, representing 605.5 hp., were included.

To the large expansion of many plants in the booming industrial districts surrounding Chicago and extending north to Waukegan and south beyond Joliet as far as Kankakee the increase is in large measure due. But that is by no means the sole cause. Many new customers—new plants beginning operations and others hitherto unprovided with electric power—have created a demand which rises into large figures. As compared with the corresponding period of 1918, the increase is over 100 per cent. For 1917 the figures were 9806 hp.

COMBINED HOPKINSON AND DOHERTY RATES SUGGESTED

Changing System of Charges Is Thought Necessary in Order that Companies May Sell Service Instead of Kilowatt-Hours

Speaking before the Iowa Section, National Electric Light Association, J. B. Hill of Iowa City expressed the opinion that utilities in towns of 5000 population and less would soon realize the necessity of selling something besides kilowatt-hours to the lighting customers on account of the increasing efficiency of lamps. He suggested that that "something" should be service and that a way to charge for it would be to install a rate schedule of the two-charge Hopkinson form with the charges based on the general theory of the Doherty rate.

Said Mr. Hill: "It should include, for example, a readiness-to-serve charge and an energy charge. The readiness-to-serve charge should include all fixed charges like interest, depreciation and certain fixed operating charges such as labor and customer charges plus a reasonable profit. The energy charge should include all variable costs such as coal, oil, water, extra labor, etc., plus a reasonable profit. In general the fixed charges exclusive of customer charges should be distributed among the major classes, namely, residence lighting, commercial lighting, power, etc., in proportion to the demand of these classes at the time of the maximum demand on the station. The charges within the major classes should be distributed on the basis of connected load or demand for the power consumer, demand or floor space for commercial lighting and floor space for residence lighting.

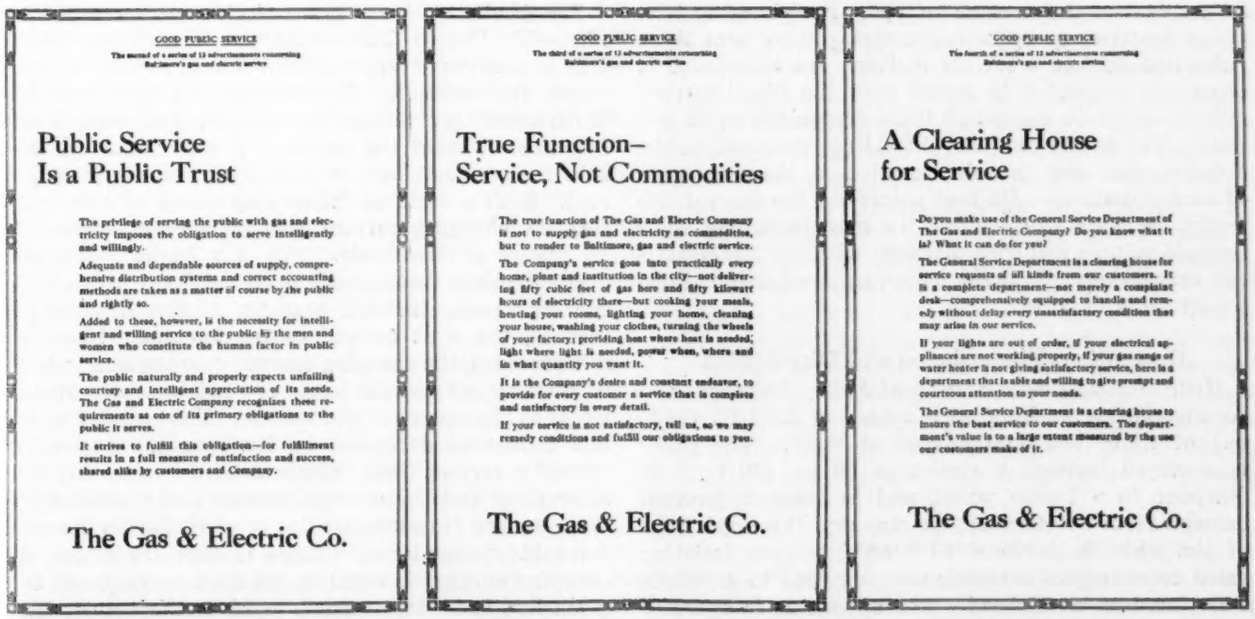
"In order to simplify the rate and take away the theoretical characteristics which might be undesirable, the number of different readiness-to-serve charges for residence and commercial lighting could be reduced to a minimum by dividing these classes into groups of four sizes, namely, very small, small, large and very large, with a definite charge to each group. To these charges should be added a customer charge for each group within the class to cover meter readings, billing and fixed charges on the service mains and meter, to complete the readiness-to-serve charge. The energy charge should be the same to all customers, and this charge would be small because it would include only the variable operating costs.

"Some of the advantages of this form of rate schedule are simplicity, fair adjustment of charges to all classes of customers, reduction to a minimum of the number of special rates which always cause dissatisfaction, the inducement such a rate would offer to the use of electricity, the tendency which the rate would have to equalize the consumer's monthly bill, making the bill approximately the same the year around, the fact that it would automatically take care of diversity and load factors so far as the public is concerned and the fact that it would cause less complaint. The two apparent objections to such a rate are that it might discourage some prospective customer and there might be some difficulty in presenting the rate to the public. Neither of these, however, is considered serious."

When Advertising Is Prohibited on Bills

The Consumers' Power Company of Grand Rapids, Mich., is required by ordinance to employ a certain kind of electric light bill the face of which must be occupied only by the bill itself, while the reverse side of the bill must be occupied by complete rate schedules. This eliminates the possibility of advertising on the bills. However, in order to take advantage of this inexpensive and effective form of advertising, Mr. Watson, who handles the electric shop for the company, has developed a number of folders. The monthly bill is gummed within this folder. Advertising matter is printed on both sides of the folder.

Emphasizing Good Public Service in Baltimore



GOOD PUBLIC SERVICE

The second of a series of 12 advertisements concerning Baltimore's gas and electric service

Public Service Is a Public Trust

The privilege of serving the public with gas and electricity imposes the obligation to serve intelligently and willingly.

Adequate and dependable sources of supply, comprehensive distribution systems and correct accounting methods are taken as a matter of course by the public and rightly so.

Added to these, however, is the necessity for intelligent and willing service to the public by the men and women who constitute the human factor in public service.

The public naturally and properly expects unfailing courtesy and intelligent appreciation of its needs. The Gas and Electric Company recognizes these requirements as one of its primary obligations to the public it serves.

It strives to fulfill this obligation—for fulfillment results in a full measure of satisfaction and success, shared alike by customers and Company.

The Gas & Electric Co.

GOOD PUBLIC SERVICE

The third of a series of 12 advertisements concerning Baltimore's gas and electric service

True Function— Service, Not Commodities

The true function of The Gas and Electric Company is not to supply gas and electricity as commodities, but to render to Baltimore, gas and electric service.

The Company's service goes into practically every home, plant and institution in the city—not delivering fifty cubic feet of gas here and fifty kilowatt hours of electricity there—but cooking your meals, heating your rooms, lighting your home, cleaning your house, washing your clothes, turning the wheels of your factory; providing heat where heat is needed, light where light is needed, power when, where and in what quantity you want it.

It is the Company's desire and constant endeavor, to provide for every customer a service that is complete and satisfactory in every detail.

If your service is not satisfactory, tell us, so we may remedy conditions and fulfill our obligations to you.

The Gas & Electric Co.

GOOD PUBLIC SERVICE

The fourth of a series of 12 advertisements concerning Baltimore's gas and electric service

A Clearing House for Service

Do you make use of the General Service Department of The Gas and Electric Company? Do you know what it is? What it can do for you?

The General Service Department is a clearing house for service requests of all kinds from our customers. It is a complete department—not merely a complaint desk—comprehensively equipped to handle and remedy without delay every unsatisfactory condition that may arise in our service.

If your lights are out of order, if your electrical appliances are not working properly, if your gas range or water heater is not giving satisfactory service, here is a department that is able and willing to give prompt and courteous attention to your needs.

The General Service Department is a clearing house to insure the best service to our customers. The department's value is to a large extent measured by the use our customers make of it.

The Gas & Electric Co.

By printing a series of advertisements, describing its attitude on matters which concern relations with the public, the Consolidated Gas, Electric Light & Power Company of Baltimore is attracting a wider interest in its affairs.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Regulation of High-Frequency Machines.—J. BETHENOD.—A consideration of the operating conditions of high-frequency machines, notably as to their electrical regulation, variations in speed, and the coupling of many alternators.—*Revue Générale de l'Electricité*, May 31, 1919.

Operation at Holtwood.—CHARLES H. BROMLEY.—The writer deals particularly with the problem of cleaning and inspection of transformers and describes the method of testing transformer oil. He states that the transformer temperatures are not permitted to rise above 60 deg. C. and in the winter are not allowed to fall below 2 deg. C. above room temperature.—*Power*, July 1, 1919.

Theory of Static Frequency Doublers.—M. OSNOS.—The Epstein frequency doubler is investigated as a special case of the simple transformer. This leads to simple methods of calculation and the derivation of a circle diagram that is applicable to the condition of load on the frequency doubler. The frequency doubler is shown to be equivalent to two transformers with their primary windings in series and their secondary windings in opposition. Resistance, inductance, leakage and other constants are worked out on this basis.—*Technical Supplement to Review of Foreign Press*, May 13, 1919. (Abstracted from *Elektrot. u. Maschinenbau*, Feb. 2, 1919.)

Pulsation in the Direct-Current Voltage in Rotary Converters.—J. K. KOSTKO.—In large rotary converters the pulsations in the terminal voltage at the direct-current end are usually not serious, but in the case of small converters the amplitude of pulsations may exceed 25 per cent of the average voltage. For charging telephone batteries or operating motion-picture arcs these pulsations become a serious matter. An inductance is commonly connected in series with the direct-current side in order to damp out these irregularities in the wave. The author analyzes the voltage produced at the direct-current end, in order to calculate the magnitude of such pulsations. He first points out the several different elements which affect the magnitude and wave form of voltage and then proceeds with the mathematical calculations of these components.—London *Electrician*, July 11, 1919.

Generation, Transmission and Distribution

Hydroelectric Power Station at Fully, Switzerland.—An installation working with a head of 5350 ft. (1630 m.) of water has been erected at Fully. The water is conveyed through a steel pipe 20 in. (50 cm.) in diameter to a Pelton wheel, and in order to prevent damage from bursts, leaky joints, etc., the upper part of the main is provided with an ingenious isolating valve consisting of a strong disk attached to a spindle and placed in an S bend. The apparatus is operated by a lever and dashpot so adjusted that the valve remains open at the normal rate of flow but closes automatically in case of emergency. A table shows the position of the balance weight on the lever for any desired opening of the valve, and the corresponding discharge, which can be adjusted for quantities varying from 72.5 gal. to 2233.1 gal. (275 l. to 8441 l.) per second. The valve was specially designed by Mr. Boucher of Brilly.—*Technical Supplement to Review of Foreign Press*, May 13, 1919. (Abstracted from *Bulletin Technique de la Suisse Romande*, April 5, 1919.)

Standardizing Frequency and Voltage for Lighting and Power Transmission.—The *Elektrotechnische Verein* (Vienna) has accepted the following scheme of standardized frequency and voltages for electric light and power transmission (excluding traction): Frequency, 50 cycles per second. Voltages—The following are working voltages to which must be added the pressure drop in transmission lines in order to determine the corresponding station voltage: Direct current, 110, 220, 440 volts; alternating current, 220, 380, 3000, 5000, 10,000, 15,000, 20,000, 35,000 75,000, 100,000 volts. If 220 volts be considered too high for lighting, 220-volt systems may be arranged on the four-wire system. If 380 volts be considered too low for power transmission, 500 volts may be used. These recommendations were to be reconsidered, amended if necessary, and then submitted for final acceptance. Various notes concerning the desirability of standardization and concerning the particular standards recommended are given in the original. The voltage values are in a "rational scale," involving ratios $1 : 2$, $1 : 3$ and $1 : \sqrt{3}$. *Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Elektrot. u. Maschinenbau*, Dec. 8, 1918.)

The Limits of Power Transmission by Alternate Current.—M. DOLIVO DOBROWOLSKY.—The author thinks that in the future direct current will be largely used for power transmission. If distances are increased and the transmitting voltage by alternating current is also increased to meet the needs of greater distance, then both factors contribute to increasing the charging current. Such a state of things may easily be arrived at that the charging current may be a very serious loss of energy at low loads. For any high-tension conductor there is theoretically a voltage limit which gives the least losses through heating: If this limit is not reached, the watt current causes too great losses; if it is exceeded, the charging current does the same. With alternating current the losses are not inversely proportional to the square of the voltage. The capacity of the line cannot be decreased by lowering the periodicity beyond a certain limit, which is fixed by lighting considerations and the costs of motors and transformers. With a given transmission line of given length the most favorable transmitting voltage is that for which the charging current is equal to the watt current. If this given line is to be extended, logically the transmitting voltage should be lowered, otherwise the charging cur-

rent will exceed the watt current. This leads to a maze of absurdities. The charging current can be compensated for by choking coils, distributed at intervals, as is done in telegraphic work, but this is expensive, complicated and not likely to be generally adopted as a solution. The effects of capacity, especially in combination with the self-induction of the line, prescribe limits to transmission by alternating current; in the author's opinion this limit is a few hundred kilometers and 200,000 volts. If cables are used, the limits are much lower, and the author is of opinion that in the future cables will largely supplant overhead wires for many reasons. The author thinks that direct current will be increasingly used for very great distances, and especially if overhead conductors are used; and, seeing that cables are certain to supersede overhead wires, it is well to remember that cables are cheaper and better with direct current. It is needful to recognize the urgent necessity of developing high-tension direct current; when this is done the ways and means must receive subsequent consideration. The existing type of dynamo may not be suitable for this work, and possibly recourse will be had to cathode-ray tubes, mercury rectifiers or various kinds of mechanical rectifiers or interrupters.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Elektrot. Zeits.*, Jan. 2, and Feb. 20, 1919.)

Electrical Characteristics of Transmission Circuits.—WILLIAM NESBIT.—In a preface to this article it is stated that the series will contain the most complete data on this subject which have ever been published. On account of the fact that most transmission lines are comparatively short and use ordinary voltages and small amounts of power, the author has included tables and charts from which reasonably accurate results may be obtained in short order. For longer transmission lines, larger amounts of power and higher voltages more accurate methods of calculating the circuits are given both by the convergent series method and also by the use of hyperbolic functions. In the first installment of the series the author deals particularly with the calculation of resistance and inductance, giving a table showing the skin effect in copper conductors of various sizes. Extensive tables are also offered for the determination of the resistance of copper conductors at various temperatures. Diagrams show the flux distribution, both magnetic and electric, about conductors carrying current to illustrate the derivation of the inductance formulas which the author derives. A table is then inserted for the determination of inductance of both solid and stranded aluminum and copper conductors for a wide range of spacing.—*Electric Journal*, July, 1919.

Sudden Peak Loads on Chain-Grate Stokers.—H. F. GAUSS.—Important features affecting the design and operation of chain-grate stokers are discussed, and a chart is presented for the determination of proper air supply for fuels of various heating values.—*Power*, July 1, 1919.

Lamps and Lighting

Incandescent Lamps for Motion-Picture Projection.—L. C. PORTER.—This article describes some changes that have been made in Edison lamps for motion-picture projection as the result of further research and experience with service installations. The lamp wattage has been increased to 900 and a tubular bulb is used in place of the spherical bulb, permitting a nearer setting of the mirror and consequently a greater volume of light. Some improvements in control apparatus have also been effected and are described in this article.—*General Electric Review*, July, 1919.

Installations, Systems and Appliances

Electrical Equipments for Movable Highway and Railway Bridges.—H. H. VERNON.—Electricity is the ideal motive power for operating the movable spans of bridges which cross navigable waterways. The application of this form of power, supplied by a central station, eliminates the heavy and wasteful standby losses that would be incurred by an isolated steam plant at the bridge. Electric drive is reliable and lends itself readily to the application of interlocking and indicating devices. The various types of movable-span bridges are defined and illustrated, and then the complete alternating-current and direct-current electrical equipment which may be applied to their operation is described in detail.—*General Electric Review*, May, 1919.

Some Experiences with Electric Welding in Warships.—W. H. GARD.—This paper was presented before the Institute of Naval Architects and gives a résumé of the scope of the present and possible future usefulness of the electric welding processes in building and repairing warships. The author cites as an example an early instance of the utility of electric welding in the repair of a battleship whose cast-steel stern post had been damaged to such an extent that the work apparently involved in restoring the strength at this vital part was too risky for electric welding. But rather than lay the ship up for a long period of repair electric welding was attempted, and after a total period of about six weeks some 600 lb. (270 kg.) of metal had been welded into the stern post and the repair was finished. After twenty-one months of sea service following this repair job it is fair to assume that the work was successful. Following this case repairs by electrical methods were widely extended by the British Admiralty, and there followed the construction of the electrically welded barge Richborough, which is well known.—London *Engineering*, July 4, 1919.

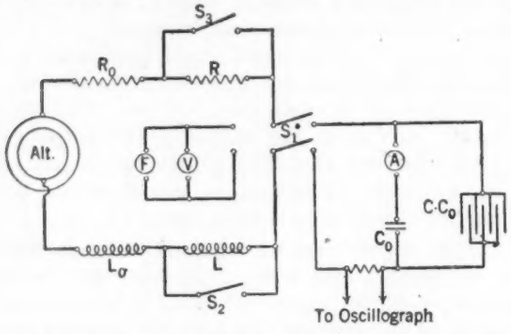
A 900-kw. War-Time Installation at Marseilles.—A. RACAPÉ.—This installation, one of those rushed to completion early in the war for the manufacture of munitions, differed from most of the others in that the apparatus and material used were entirely new instead of consisting of whatever was most easy to procure. The speed made in preparing for operation was almost as great and the reliability attained much greater. Five 100-hp. motors with automatic contactors were fed with three-phase, 5250 volt, 50-cycle current stepped down to 220 volts. Three transformers rated at 375 kva. provided for twenty-four-hour operation. The author describes the apparatus and the way in which its disposition was worked out in great detail with elaborate diagrams, and states that since the plant began operations in November, 1915, up to the present time it has been operated day and night without interruption from any cause.—*Revue Générale de l'Electricité*, May 24, 1919.

Units, Measurements and Instruments

Power Factor and Phase Rotation.—LESLIE R. CURTIS.—The writer explains methods for determining whether the current in an electric circuit is leading or lagging behind the voltage. The underlying mathematical cal-

culations involved in easy and reliable methods for determining phase rotation of voltages and effective power factor are also explained.—*Journal of Electricity*, June 1, 1919.

Order and Amplitude of Harmonics in Voltage-Wave Forms.—LESLIE F. CURTIS.—The writer explains a method of obtaining the order and amplitude of harmonics in voltage-wave forms by means of readings obtained from inexpensive indicating meters and other apparatus. The method is that of obtaining resonant conditions for the *n*th harmonic in the generated voltage by adjustments of inductance and capacitance in series with a certain amount of protective resistance. When resonance has been obtained a second reading is taken with added series resistance. The diagram of the connections used is reproduced. The alternator supplying the wave to be tested is assumed to have an inductance L_o and a resistance R_o. Resistance R and inductance L may be added to the circuit at will by switches S_1 and S_2. V and F indicate a voltmeter and frequency meter. On throwing S_1 to the right an adjustable condenser C-C_o is connected in the circuit. In parallel with this is a small fixed condenser C_o, the current in which may be measured by a small hot-wire meter A of negligible resistance. C is the total capacitance. For a given initial voltage and frequency the resonant points for the harmonics are indicated by a maximum deflection of meter A. The calculation consists of two parts—the determination of the order of the harmonics present and the calculation of their amplitude. Equations are developed to simplify these calculations.—*Proceedings A. I. E. E.*, August, 1919.

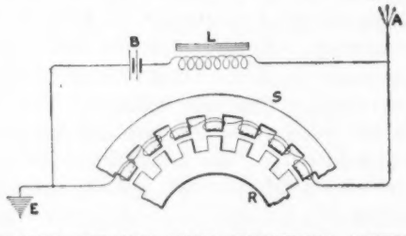


ARRANGEMENT OF APPARATUS FOR HARMONIC ANALYSIS

Telegraphy, Telephony and Signals

Wireless Developments in Germany During the War.—A. MEISSNER.—Great improvements have been made in wireless communication during the war. It was found possible to keep up communication in both directions between Germany and the colonies for at least six hours in the day, the best times being 6 to 11 a. m. and the best wave length 5500 m. With 100 kw. it was at times possible to reach Windhuk. The Goldschmidt machine at Eilvese gave much trouble and failed for long periods; nevertheless toward the end of the war, as the result of certain improvements, it became much more reliable. Its capacity was increased to 800 kw. The Nauen station, also with 800 kw. capacity, was most satisfactory in its operation. Methods of double sending by two senders acting on one antenna tuned simultaneously to two wave lengths have the advantage of attaining a greater degree of selectivity by the combination of the wave lengths. New types of cathode tube amplifiers rendered communication possible between firing trenches with very light apparatus. Blocking stations were used to interrupt the wireless communications of enemy aircraft. Directive stations were very successful in aiding Zeppelins over Paris through a thick fog. Various improvements are referred to in arc transmitters, tube transmitters, high-frequency coils, receivers, relays and antennas—*Technical Supplement to Review of Foreign Press*, May 27, 1919. (Abstracted from *Elektrotechnische Zeitschrift*, March 13, 1919.)

High-Frequency Alternators.—M. LATOUR.—The writer discusses the different types of machines which are available for the generation of high-frequency currents—that is, the types of alternators which yield directly without any external apparatus the frequency necessary for the excitation of radio-telegraphic aërials. The various arrangements may be classified as follows: (1) Machines in cascade; (2) internally cascaded machines; (3) homopolar disk machines; (4) variable-reluctance alternators; (5) alternators utilizing part only of the armature periphery. It is said that the system of machines in cascade has particular advantage for very high power, such as for the supply of 500 kw. in the aërial at a frequency of 15,000. This might be divided, for instance, into two groups of 250 kw. each or three groups of 166 kw. each. The internally cascaded machines were first proposed by M. Boucherot and operate on the following principle, as proposed by him: In a suitable alternator, with alternate poles of opposite polarity, the armature system is the seat of an emf. and a current represented by an infinite series of odd terms of the Fourier series, and the inductor the seat of an emf. and a current represented by an infinite series of even terms of the Fourier series. Concerning the homopolar disk machines, these have the advantage that the rotating parts carry no winding. Alexanderson has constructed homopolar machines for peripheral speeds up to 200 m. to 300 m. per second. In these machines, however, the hysteresis losses are higher than in the ordinary type of alternator. An early form of variable-reluctance alternator is shown in the figure. This comprises an excitation winding on the stator which constitutes at the same time the working winding by introducing the choking coil shown in the figure. When the rotor teeth are opposite the stator the flux is a maximum through the stator teeth. When the spaces are opposite the stator teeth the flux is a minimum, and an emf. is thus obtained having the same frequency as that of the homopolar machines with the same number of teeth on the rotor. The output of the variable-impedance machine is, however, much less than that of the homopolar machine in which the rotor polar projections are always traversed in the same direction by the main flux.—London *Wireless World*, July, 1919.



VARIABLE-RELUCTANCE HIGH-FREQUENCY ALTERNATOR

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

DOHERTY SCHOOL FOR THE SALESMEN OF SECURITIES

New York Organization Will Establish Free Course of Instruction for Those Who Desire to Take Advantage of It

A school for securities salesmen will be opened by the bond department of Henry L. Doherty & Company, New York. Early in September the first class will be opened, and the company has announced by advertisement in the daily newspapers that it is ready to receive applications.

No previous experience in selling securities is required, but each application will be subjected to the same scrutiny as are all applications in the Doherty Organization. An effort will be made to arrange the hours of instruction so they will not interfere with a student's present employment. There will be no fee or expense of any kind connected with this course. The first class will be limited to 100 students.

Certificates of graduation will be given those successfully completing the course, but while opportunities for employment may be offered to a few of the abler students in the class, no promise of such employment is made. Dr. L. F. Fuld is educational director of the company.

CONGRESS REPEALS THE DAYLIGHT-SAVING LAW

Both Branches Act This Week and Pass the Repealing Measure by Two-thirds Vote Over the President's Veto

By action of the House of Representatives and of the Senate this week the repeal of the daylight-saving law was passed over President Wilson's veto. The vote in the House was 223 to 101 and in the Senate 57 to 19. Repeal of the law takes effect after the clocks are turned back in October.

In returning the measure for the second time without his approval the President said that he did it with "the utmost reluctance." The President's message to the House follows:

I return this bill (H. R. 3854), "An Act for the Repeal of the Daylight-Saving Law," without my signature, but do so with the utmost reluctance. I realize the very considerable and in some respects very serious inconveniences to which the daylight-saving law subjects the farmers of the country, to whom we owe the greatest consideration. But I have been obliged to balance one set of disadvantages against another. The immediate and pressing need of the country is production, increased and increasing production, in all lines of industry.

The disorganization and dislocation caused by the war have told nowhere so heavily as at the industrial centers, in manufacture and in the many industries to which the country and the whole world must look to supply needs which cannot be ignored or postponed.

It is to these that the daylight-saving law is of most service. It ministers to economy and to efficiency. And the interests of the farmer are not in all respects separated from these interests. He needs what the factories produce along with the rest of the world. He is profited by the prosperity which their success brings about. His own life and methods are more easily adjusted, I venture to think, than those of the manufacturer and the merchant.

These are the considerations which have led me to withhold my signature from this repeal. I hope that they are considerations which will appeal to the thoughtful judgment of the House, and in the long run to the thoughtful judgment of the farmers of the country, who have always shown an admirable public spirit.

Agitation for the repeal of the daylight-saving law first came from farmers, but recently some labor unions have come out in favor of the repeal measure.

TECHNICAL LETTERS ON INDUSTRIAL LIGHTING

Course Issued by Department of Electrical Engineering in Co-operation with Illumination Committee of Ohio Electric Light Association

A set of technical letters on industrial illumination, comprising practically a university extension course, is being issued by the department of electrical engineering of the Ohio State University, Columbus, with the coöperation of the illumination committee of the Ohio Electric Light Association.

The following statement in regard to the course has been received from Prof. F. C. Caldwell, professor of electrical engineering of Ohio State University:

Industrial lighting has undergone a complete revolution within the past five years. It is a fact not generally appreciated that the man who is familiar with the principles of modern and efficient illumination has the power to increase the output of most factories from 8 to 27 per cent.

These principles form the subject matter of a correspondence or extension course now being published by the department of electrical engineering of the Ohio State University. This is a series of twelve technical letters in which the facts most essential to the successful designing of factory lighting systems are explained in a simple and practical manner.

Such subjects as the following are dealt with: Factory lighting requirements, electric lamp and reflector characteristics, lighting installation design, wiring methods, costs, maintenance. Much value is added to the course by frequent reference to a selected list of technical trade literature, which through the courtesy of the manufacturers will be supplied with the letters to all who ask for it. A set of practical problems accompanies each "technical letter" and the answers follow in the next letter. For those who care for supervision in the working of these problems arrangements for assistance can be made at a slight additional charge. A certificate will be awarded to all who complete the course under this arrangement.

For a charge of $2 the letters as far as published and the remainder as soon as they are completed will be sent upon application to the department of electrical engineering, Ohio State University, Columbus, Ohio.

PROGRAM FOR CONVENTION OF EDISON ASSOCIATION

Arrangements Provide for Important Business Sessions and Varied Entertainment—President Elden Urges Large Attendance After War Lapse

All the arrangements have been completed for the thirty-eighth convention of the Association of Edison Illuminating Companies, to be held at the Hotel Griswold, Eastern Point, New London, Conn., on Sept., 15 to 18.

In notifying members of the plans for the meeting L. L. Elden, president of the association, writes that after a lapse of three years the convention is looked forward to with unusual interest and that it is his earnest desire that it be successful from the viewpoints of assistance to the members, real usefulness and enjoyment generally.

COMBINING BUSINESS WITH PLEASURE

Business Program.—As in previous years, the business program has been divided into five sessions as follows: Tuesday morning, Sept. 16; Tuesday evening, Sept. 16; Wednesday morning, Sept. 17; Wednesday evening, Sept. 17; Thursday morning, Sept. 18. In addition to the reports of the various committees, four papers will be presented for consideration and discussion, two of which will be by representatives of the manufacturing interests on timely subjects. The other two subjects are of vital importance to the association at this particular time, namely, "A Symposium of Lamp Renewal Practice" and "The Labor Situation." Further, there will be two addresses by men of high standing, as follows, "Lessons of the War" and "Fuel," with special reference to the utilization of pulverized coal and fuel oil.

Entertainment Program.—On Monday evening, Sept. 15, the past-presidents and their wives will receive the members and guests, after which there will be dancing. The events on Tuesday, Wednesday and Thursday have been so arranged as not to interfere with the business sessions. The entertainment program this year has been arranged with water attractions in view. Boats will be available continuously, and there is a possibility of an excursion to Fisher's Island and an inspection of the fort there. An excellent bathing beach and ample bathhouse accommodations are operated in connection with the hotel. Through the coöperation of the Navy Department, an interesting program is being arranged which it is hoped will include the exhibition of a submarine, a submarine chaser and an eagle boat; also the maneuvering of a hydroplane, together with the demonstration of a wireless telephone in use between the plane and the hotel.

The Shenecossett Country Club is operated by the hotel management. Golf and putting contests, archery croquet, tennis and trap shooting are, as usual, a part of the program, and attractive prizes have been secured for the winners.

BANQUET TO BE HELD

The convention will close on Thursday evening, Sept. 18, with an informal banquet to be followed by the installation of the officers for the ensuing year and the distribution of prizes.

For the accommodation of Western members, Godfrey H. Atkin of the Electric Storage Battery Company, Marquette Building, Chicago, has volunteered to assist in arranging any details in connection with transportation.

"In view of our happier frame of mind, due to the successful conclusion of the war, and in view also of the many vital problems before us pressing for early solution," says Mr. Elden, "your officers and executive committee feel that through the personal contact offered by attending this convention much good will result to our industry and to the respective member companies and to ourselves individually. I urge upon you, therefore, that you arrange to send to the convention as many representatives as is consistent with your policy in such matters."

POPULAR ATTENDANCE AT I. E. S. CONVENTION SOUGHT

Public as Well as the Trade to Be Welcomed to Sessions of Illuminating Engineering Society at Chicago Convention

Local attendance at the 1919 convention of the Illuminating Engineering Society at Chicago, Oct. 21-24, will be stimulated in several ways. The Chicago Electrical Trades Exposition, which will be in progress at that time, will afford one excellent means of getting convention advertising to the public. For this purpose colored posters are being prepared for exhibition at the electrical exposition, calling attention to the fact that the sessions are open to the public and offering suggestions as to where programs can conveniently be obtained. These posters will be displayed in many parts of the show.

The Chicago Section of the Illuminating Engineering Society will put on an active membership drive just before the convention. This too is expected to have its effect on the local attendance.

CONVENTION OF IRON AND STEEL ELECTRICAL ENGINEERS

Tentative Program for the Thirteenth Annual Meeting, to Be Held at St. Louis on Sept. 22 to 26, Shows Wide Range of Subjects

The Association of Iron and Steel Electrical Engineers will hold its thirteenth annual convention at the Hotel Statler, St. Louis, on Sept. 22 to 26. Following is the tentative program of papers to be presented at the convention:

Standardization committee report, by T. E. Tynes, chairman.

Educational committee report, by A. B. Holcomb, chairman.

Safety committee report, by Walter Greenwood, chairman.

Electric furnace committee report, by Ralph D. Nye, chairman.

"Organization of the Electrical Department in the Steel Industry," joint paper: "Organization of the Operating Force," by H. C. Cronk; "Electrical Repair Shop," by C. A. Menk; "Storeroom and Spares," by T. E. Tynes; "Educational Training for Electrical Employees," by B. A. Cornwell; "Operation and Inspection," by A. Morgan and J. J. Booth; "Records and Testing," by R. B. Gerhardt.

"Alternating Current Versus Direct Current for Table Motor Drive," by W. S. Hall; "High-Speed Motors with Herringbone Gears Versus Slow-Speed Motors," by J. E. Fries.

"High-Temperature Furnaces," by C. A. Winder.

"Meter Equipments in Steel Mills," by Paul M. Lincoln.

General discussion on the following topics:

"Overload Protection on Cranes," by A. G. Place; "Crane Controllers," by James Maloney; "Motor Starters," by Walter C. Kennedy; "Design, Operation and Upkeep of Lifting Magnets," by James Farrington.

"Recent Improvements in Industrial Control," by H. D. James.

"Present Status of Arc Welding in the Steel Industry," joint paper by A. Churchwarden of the Wilson Welder & Metals Company, H. L. Unland of the General Electric Company, A. M. Bennett of the C. & C. Electric Arc Welding Company, R. E. Kinkead of the Lincoln Electric Company, a representative of the Electric Arc Cutting & Welding Company, C. B. Waters of the Arcwell Corporation and A. M. Candy of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

MUNICIPAL ELECTRICIANS ARE TO MEET IN CHICAGO

International Association to Hold Its Twenty-fourth Annual Convention on Sept. 23 to 26 and a Program of Special Interest Is Promised

The twenty-fourth annual convention of the International Association of Municipal Electricians will be held at Chicago, Sept. 23 to 26. Secretary George writes that this year's convention is to be one of special interest and that no municipal electrician or superintendent of fire and police alarm telegraph can afford to fail to attend. The Auditorium Hotel will be official headquarters. Entertainment features will be provided for the ladies. Manufacturers of electrical appliances are especially invited to exhibit.

Information in regard to exhibits may be obtained from W. S. Boyd, secretary committee on arrangements, 175 West Jackson Boulevard, Chicago.

COMPANIES ENTITLED TO FURTHER RATE INCREASES

President Hulswit of United Light & Railways Company Says that Requests of Subsidiary Operating Properties Are Being Received Favorably

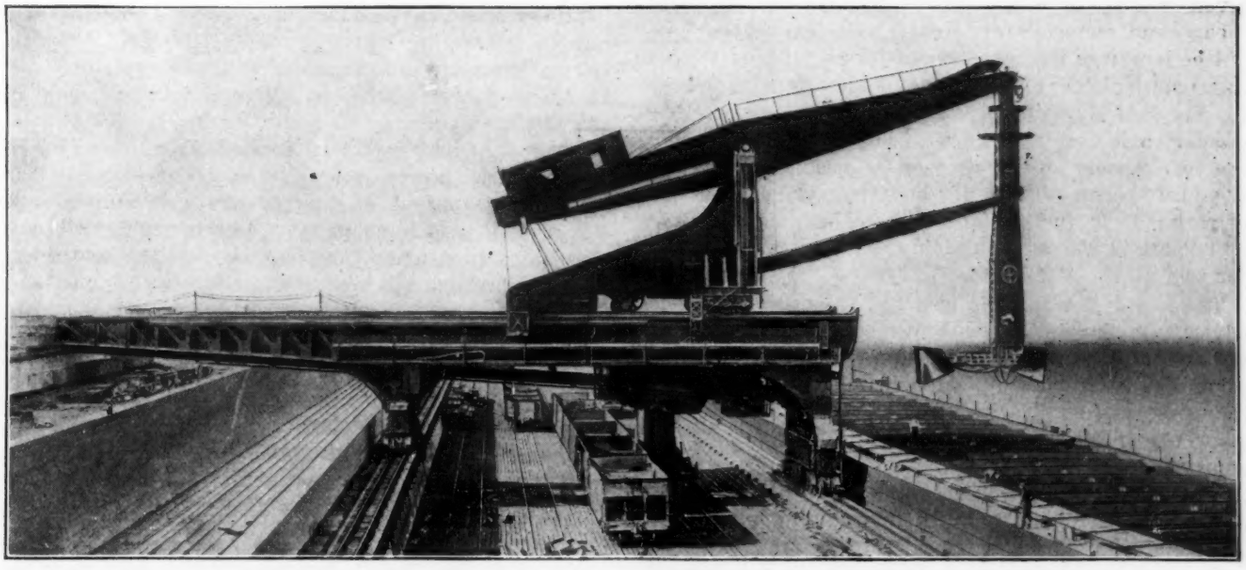
President Frank T. Hulswit of the United Light & Railways Company, Chicago, speaks of costs of operation and future prospects in his annual report to stockholders for 1918.

The gross earnings of the company's subsidiaries show a very material increase in all departments, but, in common with all public utilities, owing to the increased cost of materials and labor, the resulting net earnings do not show any increase. However, during the latter portion of the year, especially the last three months, the company received the benefit of rate increases in practically all of the communities served, and at present the ratio of increase in gross earnings is more than offsetting the increase in operating expenses.

"Your board, however, is convinced," Mr. Hulswit adds, "that the subsidiary companies are entitled to still further increases in rates for service and is pleased to state that the subsidiary companies' requests for increases are being favorably received. A number of increases have been granted since the close of the calendar year and others have been applied for.

"Business conditions at present in all of the communities served are excellent, and the transition from war to peace basis has not harmfully affected the communities your subsidiary companies serve. In fact, in a majority of instances business conditions are better now than during the war period. Crop conditions are also very good and are even better than at the same time in 1918."

Automatic Ore Unloaders Operate on Central-Station Power



More than fifty of this type of machine are in use on the Great Lakes unloading ore steamers. Those shown are at Ashtabula, Ohio. Each is equipped with a 15-ton bucket, and the unloading capacity of the eight machines is 76,000 tons in twenty-four hours. In other words, these machines can unload the total cargoes of six of the largest ore-carrying vessels on the Great Lakes in one day. This work is done with central-station energy. Each motor is equipped with eight motors totaling 930 hp. Records extending over a considerable period of time show an unloading cost of 2½ cents to 4½ cents per ton, including superintendence, labor, materials and power. Because of the fact that the duty cycles of the machines are not likely to coincide regularly the total demand with all machines operating is relatively uniform and the load is large enough and of such duration that it is very attractive.

CITY URGED TO PROVIDE MORE ELECTRICAL SCHOOLS

New York Industrial Survey Reveals Need for Increase in Number of Evening Trade Courses and Improved Facilities for Handling Workers

Establishment of a greater number of day and evening courses in inside electrical work, as well as improved methods of teaching, are advocated in the report of the industrial education survey of the city of New York, which has just been completed. The committee in charge of the survey made a study of four trades—printing, inside electrical work, carpentry and the machinist's trade. The report on inside electrical work forms Part 2 of the survey. The findings were submitted to the conference committee appointed by the Electrical Contractors' Association and the Independent Electrical Workers' Union, which approved the recommendations.

The field work in relation to this investigation was conducted by experts from the trade, who found that in the electrical trade more than in any other the worker's effectiveness depends on knowledge rather than skill. The number of those wishing to take courses in electricity is rapidly increasing, while the present facilities are inadequate. While the total number of electrical workers was found to be only 6815, more than 1300 men have now registered in the evening electrical classes.

The report of the committee urges that the board of education establish two trade schools and consolidate in these schools the electrical equipment now used in the three-day vocational schools and the evening trade schools. The attendance in the electrical classes should, in the committee's opinion, be limited to 400 students. It is also recommended that the board of education establish part-time trade-extension classes for apprentices in the electrical trade, and that courses be given in trade drawing, applied mathematics, electrical theory and materials and tools. The employers' committee will urge the members of its association to send their apprentices to part-time trade-extension classes for one-half day (four hours) a week with pay. It is suggested that the board of education centralize in the two schools all the courses in electrical work and organize special courses for electrical journeymen and helpers. It is further urged that the unions require all helpers to attend the evening trade-extension classes for two nights a week for two years.

The board of education is urged to appoint a special advisory committee of nine members to assist in developing the courses in electrical work, such advisory committee to be made up of four employers representing the employers' association, four employees representing labor organizations, and these eight to nominate one additional member, who shall be a layman.

The evening school courses recommended by the committee are as follows: Blueprint reading, elementary trade drawing, advanced trade drawing, applied mathematics, cost estimating, electrical theory for helpers, electrical theory for journeymen, course in city and national electrical code requirements, and shop courses for helpers. Courses recommended for journeymen are: Low-tension work, high-tension work, alternating-current work, direct-current work, automatic control, sign flashers and general house wiring.

The report of the advisory committee on day vocational schools declares that a specialized central school backed by the interest of the trade, dealing in part-time and trade-extension classes, and standing before the community as the headquarters of the trade, will present a situation much more likely to attract a group of pre-employment pupils who have already formed their desire to be trained in that particular trade than schools in which this trade course appears only as an element among other courses.

POWER CONDITIONS IN GREAT WESTERN SYSTEM

Situation of Steam Plants Changed from Reserve to Position of Primary Power—President Fleishhacker Describes Plans for Development

In his annual report to stockholders for 1918, M. Fleishhacker, president of the Great Western Power System, San Francisco, discussed the situation arising from water shortage and the plans for new construction.

"Owing to the increasing power demands in this district with no hydro development," said Mr. Fleishhacker, "the situation of steam plants has changed from a reserve to a position of primary power. This condition was greatly aggravated in 1918 by a dry season, and the question of whether the combined steam and hydro facilities of all companies in the district could meet the demand was serious. The large utilities of central California, therefore, formed a power association to meet these shortages, and our large reservoir made this company a most important factor in relieving the power shortage.

"Work on the Caribou plant is now under way, Stone & Webster having been retained to design and superintend its erection. From present indications it appears possible that the first two units of 40,000 kw. may be in operation by the end of 1920.

"When this new plant is completed the company will have a generating capacity of 105,000 kw. of hydroelectric power, which, together with the present 34,500 kw. from steam plants, will give a total capacity of 139,500 kw.

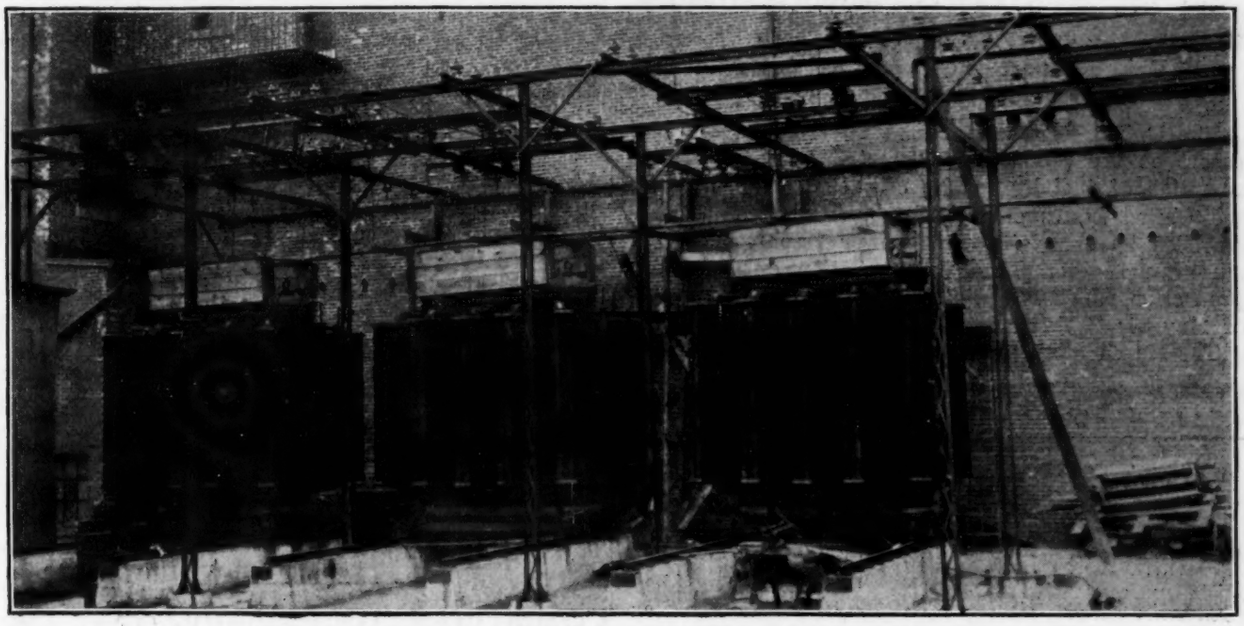
"The principal profit is derived from the sale of hydroelectric power, and the new development will increase the output of this power over 50 per cent. All of this additional power can be sold within a reasonable time after the plant is installed, and every effort, therefore, will be made to hurry its completion."

FOREIGN INVESTMENT IS NEEDED IN CHINA

Gerard Swope, President International General Electric Company, Says that Funds Should Be Placed There in Unselfish Spirit

Gerard Swope, president of the International General Electric Company, has returned from a trip to Japan and China. Mr. Swope expressed the opinion that the urgent need of China is the investment of foreign capital in development of her natural and industrial resources. If the greatest good is to be accomplished for China and for civilization, these funds, Mr. Swope believes, must be placed in an absolutely unselfish spirit with no thought of gaining political ascendency over the Chinese.

Transformers for Boston Edison-New England Power Company Transmission Tie Line



The three 5000-kva. transformers shown above constitute the first link between the Boston Edison and New England Power Company systems, which are now being connected by a transmission tie line. The transformers are being erected at the L Street station of the Edison company in South Boston and will raise the pressure from 13,800 to 25,000 volts for energy transmission through two underground cable circuits to Baker Street, Dedham. Here the line voltage will again be raised to 66,000 for transmission to Sudbury and Clinton. These points are already connected with Boston through the 13,800-volt lines of the Edison company, which take energy at Sudbury and from Clinton by purchase from the hydroelectric plants of the Metropolitan Water and Sewerage Board. The new high-voltage tie will enable the New England company to purchase off-peak energy from Boston and will permit the supply of energy by the two large companies concerned to be furnished more advantageously from the service standpoint.

ELECTRICAL OPPORTUNITIES IN THE ORIENTAL NATIONS

China and Japan Offer Attractive Markets for American Apparatus—World-Wide Necessity for Increased Production

China and Japan are rapidly awakening to the value of American electrical products, according to Charles F. Weed, vice-president of the First National Bank of Boston, who has recently returned from a seven months' tour of the Orient. To a representative of the ELECTRICAL WORLD Mr. Weed said that the opportunities for electrical trade in the Far East are now excellent and that in none of the Asiatic countries which he visited are electrical facilities established on anything like the scale familiar in America. "When I was at Shanghai," said Mr. Weed, "I had the pleasure of inspecting the local lamp factory of the International General Electric Company with Gerard Swope, president of this organization. Under American supervision Chinese men and women are producing high-grade incandescent lamps at lower cost and of equal quality as compared with the products of our own country. Given the necessary training, these workers exhibit remarkably deft performance combined with interest in their tasks and faithfulness in service."

Clark H. Minor, of the China Electric Company, Pekin, called Mr. Weed's attention while in the East to the potential market for electric street-lighting equipment in China. At present much interest is being displayed in this branch of the electrical art. Cotton manufacturing plants are coming into vogue in China, five new products having placed orders in the past few months, and these would seem to offer American electrical manufacturers a possible outlet for motors and other equipment. Another opportunity for development lies in the telephone field. The facilities in China are on such a moderate scale that even in the larger cities the telephone book is about the size of one required for a little New Hampshire town.

"Japan," said Mr. Weed, "is keenly interested in American electrical products and is now taking up the development of water power with considerable energy. Machinery for hydroelectric service is greatly needed and Japan is now a market of the first rank for this class of manufactured products. The telephone service is not yet developed to a magnitude comparable with American installations. In a Tokio banking house I desired to telephone Yokohama, 18 miles (28.8 km.) distant; but found that a call could not be put through inside of an hour and a half on account of the density of traffic. Java, which I also visited, appeals to me as the best possible market for electric fans, once the Dutch obsession that these devices produce baldness can be overcome. For the time being Australia does not appear to offer such wide opportunities for the introduction of American electrical products as could be desired, for the reason that internal economic and political conditions are somewhat disturbed. One of the chief lessons of the trip was the emphasis it laid upon the worldwide need of doing everything possible to increase production, to avoid all tendencies toward limitation of output and to cultivate individual and collective efficiency with vigor and enthusiasm."

GEOLOGICAL SURVEY'S DATA ON POWER SUPPLY

Statistics Issued for March Show that of Average Daily Kilowatt-hour Output 41 per Cent Was Produced by Water Power

The United States Geological Survey has issued a report on the production of electric power and consumption of fuel by "public utility power plants" in the United States during March, 1919. The report, compiled by the division of power resources of the survey, follows the initial compilation on February production, which was printed in the ELECTRICAL WORLD of May 31, 1919, page 1184.

The March report is based on returns received from 3075 electric power plants engaged in public service, including central stations, electric railways and certain other plants the output of which contributes to the public supply. Returns were received from plants representing about 89 per cent of the total generating capacity. The output for the month averages 101,400,000 kw.-hr. per day, of which 41 per cent was produced by water power. The average consumption of coal per kilowatt-hour of plants using coal which made returns was about 3 lb.

POWER SUPPLY OF THE UNITED STATES

State	Thousands of Kilowatt-Hours Produced: By Water Power	By Fuels	Combustion of Fuels: Coal, Short Tons	Petroleum and Derivatives, Barrels	Natural Gas, Thousands of Cubic Feet
Alabama	30,275	4,907	16,467	0	0
Arizona	6,689	21,807	6,160	88,011	0
Arkansas	72	6,620	11,177	489	85,398
California	215,914	33,939	0	185,127	181,785
Colorado	14,254	17,144	44,079	95	0
Connecticut	14,884	37,469	62,234	323	*12,615
Delaware	0	4,784	7,713	17	0
District of Columbia	0	19,172	20,483	0	0
Florida	892	8,789	5,594	199,149	0
Georgia	37,264	6,082	11,934	120	0
Idaho	39,913	257	111	10	0
Illinois	15,282	207,705	351,289	2,198	0
Indiana	3,648	54,613	157,896	167	2,108
Iowa	48,502	25,051	78,739	730	0
Kansas	1,223	30,775	51,932	60,233	85,996
Kentucky	4	19,127	39,386	351	0
Louisiana	0	14,866	14,560	29,419	47,458
Maine	20,157	73	348	7	0
Maryland	371	13,898	23,657	18	1,500
Massachusetts	31,365	100,034	143,453	14	0
Michigan	59,650	96,101	124,841	104	0
Minnesota	34,881	16,848	46,346	992	0
Mississippi	0	5,399	16,542	349	0
Missouri	5,920	38,396	90,495	19,580	0
Montana	77,861	854	5,686	563	960
Nebraska	959	16,687	32,984	3,349	0
Nevada	2,450	121	180	1,044	0
New Hampshire	7,971	1,958	3,696	20	0
New Jersey	197	76,775	116,525	103	0
New Mexico	56	1,556	4,438	1,360	0
New York	222,318	288,191	363,319	546	164,408
North Carolina	46,333	7,426	16,234	20	0
North Dakota	0	2,453	17,116	504	0
Ohio	3,932	194,850	321,987	842	†323,020
Oklahoma	183	12,981	13,153	5,594	440,094
Oregon	29,014	3,779	433	14,345	0
Pennsylvania	62,509	246,989	408,264	14	54,450
Rhode Island	805	18,405	22,024	0	0
South Carolina	43,417	4,045	9,540	33	0
South Dakota	3,579	4,042	12,325	3,463	0
Tennessee	45,222	10,680	28,724	84	0
Texas	200	48,034	34,789	181,318	179,760
Utah	15,463	0	61	0	0
Vermont	18,393	179	412	2	0
Virginia	20,221	18,774	22,475	13	0
Washington	79,347	4,521	3,473	18,804	0
West Virginia	1,593	58,108	70,717	58	142,688
Wisconsin	37,569	33,053	77,139	662	0
Wyoming	172	3,898	19,907	2,539	18,349
Total	1,300,924	1,842,214	2,931,037	822,783	1,740,094
Combined total	.....	3,143,138	.....	.....	.....

* Artificial gas. † 67,156 ft. artificial gas.

The report states that production of power in Utah and the coal consumed in Iowa, as given in the February report, are considerably in error, owing to receipt of incorrect reports from power plants. A revision of the February report will accompany the April report. These reports are subject to revision in subsequent statistical reports of the United States Geological Survey relating to power production.

Comparison with the report for February, published in the ELECTRICAL WORLD for May 31, 1919, shows that the daily power output fell off in March, the output for February having been 110,000,000 kw.-hr. per day. The percentage of power obtained from water increased, however, to 41 per cent, in comparison with 39 per cent during February.

The report is intended to show the complete power production and fuel consumption of all electric power plants in the United States engaged in the public service, including electric railways. For the plants that did not submit returns or were unable to furnish their output estimates were made as accurately as possible from available information.

COMMITTEES ON REVISION OF NATIONAL ELECTRICAL CODE

Personnel of Special Committees Appointed by Chairman Pierce of Electrical Committee, N. F. P. A., to Consider 1920 Code

Special committees have been appointed by Dana Pierce, chairman of the electrical committee of the National Fire Protection Association, to consider various questions in anticipation of the 1920 code. All persons interested in any of these questions are invited to communicate with the chairmen of the technical sub-committees as given below, which are grouped under the standing committees through which they will report:

1. *Standing Committee on Cars and Railways* —M. Schreiber, chairman, American Electric Railway Association, Newark, N. J.; R. C. Bird, Ralph Sweetland. Revision of rules on carhouse wiring; car wiring for more than 600 volts.

The American Electric Railway Engineering Association has appointed two committees to coöperate with the standing committee on the above topics.

2. *Standing Committee on Devices and Materials.*—A. R. Small, 207 East Ohio Street, Chicago, chairman; H. O. Lacount, H. R. Sargent.

Technical Sub-Committees:

a. Wires and Cords: Stranding, indentification, types, etc. B. H. Glover, chairman, 207 East Ohio Street, Chicago; G. E. Bruen, V. H. Tousley, G. S. Lawler, H. A. Morss, W. S. Clark, W. F. Field.

b. Cabinets and Cut-out Boxes: A. O. Boniface, chairman, 207 East Ohio Street, Chicago; E. C. Horton, J. Johnson and representative of A. M. E. S.

c. Outlet Boxes and Covers: E. P. Slack, chairman, 25 City Hall Place, New York; F. D. Varnam, L. A. Barley, H. G. Knoderer.

d. New 10-Amp. Classification of Fuses: A. R. Small, chairman; W. C. Peet, H. R. Sargent.

3. *Standing Committee on Fixtures, Heaters, Signs and Lamps.*—J. C. Forsyth, chairman, 123 William Street, New York; G. E. Bruen, C. H. Lum.

a. Heaters: J. C. Forsyth, chairman, 123 William Street, New York; I. Osgood, R. B. Shepard, H. J. Mauger, Harold Fulwider, Frank Kuhn, C. J. Killam.

b. Fixtures and Insulating Joints: J. C. Forsyth, chairman; Emil Anderson, K. W. Adkins, A. Waldschmidt, V. H. Tousley, C. H. Hill, H. S. Wynkoop, Louis McCarty and

representatives of the National Fixture Manufacturers' Association.

c. Incandescent Lamps, Gas-Filled; Use of Lamps in Dusty Places: G. E. Bruen, chairman, 123 William Street, New York; F. F. Burroughs, R. P. Strong, W. T. Blackwell.

d. Extensions from Fixture and Other Outlets: G. E. Bruen, chairman, 123 William Street, New York; E. H. Joseph and representative of outlet-box manufacturers.

4. *Standing Committee on Generating and Substations.*—A. M. Schoen, chairman, Southeastern Underwriters' Association, Atlanta, Ga.; W. H. Blood, K. W. Adkins. The following topics to be treated by this standing committee: (a) Use of switches between generators and transformers; (b) Revision of Rule 1-d on fusing of generator sets.

5. *Standing Committee on Grounding.*—W. H. Blood, chairman, 147 Milk Street, Boston; C. M. Goddard, H. S. Wynkoop.

(a) Grounding Motor Frames: W. H. Blood, chairman; G. S. Lawler, W. C. Peet.

The standing committee has under consideration the following topics: (a) Size of ground wires; (b) voltage limits for grounding; (c) omission of grounding for short lengths of conduit, metal raceways, etc.; (d) minor items of Rules 15 and 15A.

6. *Standing Committee on Industrial Applications.*—G. S. Lawler, chairman, 31 Milk Street, Boston; F. Osgood, C. B. Langdon, J. M. Curtin.

(a) Fuse Protection of Motors: E. E. Turkington, chairman, 31 Milk Street, Boston; J. C. Forsyth, E. McCleary, W. J. Canada and a representative of the Electric Power Club.

(b) Use of Oil Transformers, Autostarters and Motor-Starting Devices: C. B. Langdon, chairman, 266 Pearl Street, Hartford, Conn.; F. O. Evertz, F. A. Barron, T. C. Taliaferro, and a representative of the Electric Power Club.

(c) Demand Factors in Wiring: Bassett Jones, chairman, 101 Park Avenue, New York; C. H. Hill, A. M. Paddon, A. S. Adams, H. B. Gear.

(d) High Potential Wiring: G. S. Lawler, chairman, 31 Milk Street, Boston; W. S. Boyd, A. E. Silver, D. W. Roper, C. C. Harbinson.

(e) Use of Inclosed Switches: Washington Devereux, chairman, Bullitt Building, Philadelphia; Ben. W. C. Clark, H. F. Strickland, P. H. Bartlett and representatives of the Associated Manufacturers of Electrical Supplies and of the Electric Power Club.

(f) Fireproof Switchboard Rooms and Running Mains in Hazardous Rooms, etc.: A. M. Paddon, chairman, Gurney Building, Syracuse, N. Y.; C. B. Langdon, W. S. Boyd, E. E. Turkington, C. H. Hill.

(g) Housing of Motors in Dusty Places, Etc.: F. F. Burroughs, chairman, Mutual Fire Prevention Bureau, Oxford, Mich.; H. W. Hadlock and representatives of the Electric Power Club and the flour and elevator insurance companies.

(h) Revision of Code Rule No. 88: W. C. Peet, chairman, 70 East Forty-fifth Street, New York.; H. S. Wynkoop, R. P. Strong.

(i) Electrical Equipment of Lacquer and Varnishing Rooms: A. C. Hutson, chairman, National Board of Fire Underwriters, 76 William Street, New York; O. E. Smith, H. S. Wynkoop.

7. *Standing Committee on Outside Wiring, Building Supply and Services.*—M. G. Lloyd, chairman, Bureau of Standards, Washington; C. H. Hill, F. F. Burroughs. This committee has under consideration the following: (a) Transformer vaults; (b) location of service conduit near combustible material; (c) supports for service wires on buildings; (d) inclosed service switches; (e) revision of Rule 12-d; (f) sizes of service wires and use of multiple-conductor wire for services.

8. *Standing Committee on Signal Systems.*—W. S. Boyd, chairman, 175 West Jackson Boulevard, Chicago; A. M. Paddon, C. W. Mitchell. This committee with the following will act as sub-committee on revision of Rule 85 of the code: F. A. Raymond, C. C. Johnson, H. S. Warren, Frank Bean, S. L. Burgher.

9. *Standing Committee on Theaters, Moving-Picture Establishments, Places of Public Assembly and Garages.*—Washington Devereux, chairman, Bullitt Building, Philadelphia; V. H. Tousley, C. M. Tait.

(a) Theaters and Moving-Picture Wiring Standards: Washington Devereux, chairman; F. A. Barron, B. A. Hanson, C. M. Tait, V. H. Tousley, Joseph Honey, J. C. Moulton.

(b) Exit Light Transformers, Low Voltage: V. H. Tousley, chairman, City Hall, Chicago; F. A. Barron, B. H. Glover.

(c) Elevator Wiring Standards: Washington Devereux, chairman; W. Doane, C. H. Hill, A. Marks, O. B. Cummings, I. N. Haughton, O. F. Shepard.

(d) Film Rewinders: W. A. Lodge, chairman, 207 East Ohio Street, Chicago; L. M. Swaab, F. H. Richardson, Lee Johnson, H. N. Speer.

10. *Standing Committee on Wiring Standards and Systems.*—W. C. Peet, chairman, 70 East Forty-fifth Street, New York; Dana Pierce, F. Overbagh, R. P. Strong.

(a) Conduit Work; Sizes of Wires; Distance between Pull Boxes, etc.: G. M. Sanborn, chairman, Sanborn Electric Company, Indianapolis, Ind.; A. O. Boniface, John Cole, O. E. Smith.

(b) Wattage Limits for Branch Lighting Circuits: I. Osgood, chairman, 55 Kilby Street, Boston; Bassett Jones, Milton Jones, Albin Gustafson.

(c) Farm-Lighting Equipments: Dana Pierce, chairman, 25 City Hall Place, New York; B. H. Glover, C. A. Bates, H. L. Bunting, F. F. Burroughs, W. S. Boyd, C. H. Hill, R. W. E. Moore, R. H. Grant, W. Michaelson, J. E. Cross.

(d) Voltage Limit for Low-Potential Systems: W. C. Peet, chairman, 70 East Forty-fifth Street, New York; H. O. Lacount, H. R. Sargent, C. B. Langdon.

(e) Wiring in Places Subject to High Temperatures: H. S. Wynkoop, chairman, Municipal Building, New York; E. McCleary, R. P. Strong.

(f) Interbuilding Connections: H. S. Wynkoop, chairman, Municipal Building, New York; other members to be appointed.

(g) Extension Wiring in Fireproof Buildings: Committee to be appointed.

Chicago's October Electrical Show

Elaborate plans are being made for the Chicago Electrical Trades Exposition. A feature will be the light from 26,000 jewels from the display at the San Francisco fair.

BRITISH GOVERNMENT SEEKS CONTROL OF WATER POWERS

Premier Lloyd George Tells House of Commons that It Is Necessary to Supplement Coal Power by Water-Power Development

Premier Lloyd George, speaking before the House of Commons in England on Monday of this week, announced that the government purposed to submit at the autumn session of Parliament a bill for the development and control of the water power of the country for industrial purposes. It would be necessary, he said, to supplement coal power by using water power.

ELECTRICAL ENGINEERS ON THE ENGLISH SUPPLY BILL

Institution of Electrical Engineers, Writing to Prime Minister, Urges Faith with Those Who Invested Under Conditions of Earlier Legislation

A statement in regard to the electrical supply bill now pending in England has been sent on behalf of the council of the Institution of Electrical Engineers, and signed by C. H. Wordingham, the president, to the Prime Minister. Among the various suggestions made is general opposition to the proposed terms for the purchase of generating stations and transmission systems and that Parliament should not break faith with those who invested capital on the strength of powers conferred by earlier legislation. The statement in full follows:

The Institution of Electrical Engineers is the representative body which comprises within its membership British electrical engineers engaged in every branch of the electrical profession and industry. The council recognizes the national importance of the question of electricity supply in its bearing on fuel economy and cheap power for industry, and every member of the Institution is directly or indirectly concerned in a greater or less degree with the effects of the electricity supply bill now before Parliament. On these grounds the council feels that some expression of opinion by it on behalf of the Institution is called for on the principles underlying the bill and on the necessity for legislation.

Before making its observations the council has conferred with the territorial centers of the Institution and with the principal representative associations concerned, either as suppliers or as consumers of electricity, and the conclusions set forth below find either unanimous or majority support.

It is recognized that great injury to the national interest has resulted from ill-considered electrical legislation in the past, the effect of which has been to check the technical and commercial progress of this key industry in all its departments.

When, therefore, fresh legislation is introduced by the present bill, its provisions are examined at once with hope and anxiety, in so far as they promise to remedy the defects of past legislation or threaten to impose new restrictions.

The proposal in the bill to appoint electricity commissioners is universally welcomed in so far as it provides for simplified procedure and control. Such an authority should impartially survey the conditions in any district from the point of view of the best interests of consumers, should remove artificial obstacles to the cheapening of supply, and should, by coördination of existing resources, not only effect improvements itself, but afford greater opportunity for progressive development by the various undertakings engaged.

The council recommends that all the commissioners should give whole-time service, and that they should themselves appoint an advisory council, membership of which should be restricted to persons possessing expert qualifications. There is general approval also of the charging of such commissioners with power to undertake and promote research.

Such opportunity for unimpeded enterprise has never before been granted to the supply authorities, and it is therefore urged that they should be permitted and encouraged to do their utmost for the public service, under the general jurisdiction of the commissioners, before that body proceeds, as contemplated by the bill, to set up district electricity boards.

Especially in view of the widely varying local conditions, it is felt that the bill should not attempt to impose a rigid system of uniformity for all parts of the country, and that the commissioners should be given latitude to facilitate schemes suitable for each district, giving first attention to the coördination and logical extension of existing systems.

There is general opposition to the proposed terms for the purchase of generating stations and main transmission systems, and it is urged that Parliament should not break faith with those who have invested their capital on the strength of the powers conferred by earlier legislation.

It is also strongly urged that all whose positions may be adversely affected in consequence of changes brought about by the bill, whether on the staff or as wage earners, should be liberally dealt with, and that if representation is given to labor on any governing body, the engineering staffs should be similarly represented and should also have the right to refer to arbitration for the settlement of differences arising out of their employment.

Having regard to the admittedly great importance of electricity supply, and the fact that practically every industry in the country is largely concerned therein, it is emphatically the opinion of the council that the electricity commissioners should be responsible to Parliament, through the President of the Board of Trade, and should not be under the Ministry of Ways and Communications.

THEODORE N. VAIL—"STILL ON THE BRIDGE"

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Public Acquisition of Part of System.—A decision of the Pennsylvania Public Service Commission, affecting property of the United Light, Heat & Power Company in Hooversville, holds that a borough may condemn and acquire the transmission system, transformers, poles, wires, etc., of a public service company for the purpose of lighting the streets of said borough and for supplying electrical energy to the public without taking over that part of the system which lies beyond the borough limits. It appearing to the commission that in the present instance the acquisition of the electrical system was necessary and proper for the service, accommodation, convenience and safety of the public, the commission approved of the same and ordered that a certificate of public convenience be issued.

Jurisdiction Over Inter-Utility Service.—The Illinois Public Utilities Commission holds that the intent of the law is to give it complete jurisdiction over every product or commodity sold by a public utility for any purpose whatsoever so long as this product and commodity partakes of the nature of a public utility service or directly or indirectly exerts an influence upon such a service. This point was raised in a case in which service was furnished by one company to another. The contention is made that the furnishing of service by the East St. Louis Light & Power Company to the St. Clair County Gas & Electric Company is not a public utility function. The commission cannot subscribe to this theory. While theoretically the St. Clair County Gas & Electric Company may be free to contract for service of this character with any other public utility in the state, as a matter of actual concrete fact this latitude of choice does not exist for the reason that other public utilities may not operate within a reasonable distance and may not render service of a suitable character practically applicable to meet the requirements of the situation. The contention is also made that the public is in no way interested in such contracts. It would appear, however, that the interest of the public is a very direct and vital one. It would be entirely possible and in some cases the circumstances have arisen that the contracts entered into between two public utilities have been entirely unjust and unreasonable and have placed an undue burden upon the one or the other. This burden, if of sufficient extent, as it may readily be, might operate to place the public utility in such financial difficulties that the rendering of adequate service to the remainder of the public would be impossible. Certainly it is the intent of the law that under such circumstances the commission should have the right to intervene and adjust the contract upon an equitable basis so that as a net result the public will receive service of an adequate and sufficient character, while the public utility shall continue to live and operate with reasonable profit. It is the intent of the Public Utilities Commission law to give the commission jurisdiction over a public utility sufficient to protect the public in all features of the service rendered and the rates charged. Should it develop as a result of a contract of this character that the inter-utility service furnished is inadequate, subject to interruptions, or in any other way unsuitable for meeting the publilc convenience and necessity, it is the apparent intent of the law that the commission shall have the full right to determine the facts and order such modifications of the contract or the methods of operation of the properties as will result in the securing of service for the public which shall meet its necessity and convenience.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Iowa State Association of Electrical Contractors and Dealers.—The general meeting of this association is scheduled for Sept. 22 and 23 and is to take place in Sioux City, Iowa.

National Association of Electrical Inspectors.—The reconstruction convention of this association will be held in the municipal auditorium of Springfield, Mass., on Monday and Tuesday, Oct. 13 and 14.

Northwest Electric Light and Power Association.—This organization is to hold its annual convention in Seattle from Sept. 10 to 13. The program for the meetings includes the technical committee report by G. E. Quinan, chairman; a paper on accounting by J. S. Simpson; an illustrated lecture by Dr. W. H. Eastman on electrical events of the war period; a paper on the value of public utility war experiences and their effect on the future by W. H. McGrath; a paper by C. A. Winder on industrial electric heating, and round-table conferences on improving electrical merchandising and on ranges and water heaters, the former being led by W. B. Putnam and L. A. Lewis and the latter by A. C. McMicken. The election of officers is to be followed by the annual banquet, at which W. J. Grambs will give a paper entitled "Reminiscences."

N. E. L. A., Grand Island Section.—The Grand Island (Neb.) company section of the National Electric Light Association has been reorganized and has elected V. M. Johnson, president; R. T. Pfeiffer, vice-president, and W. J. Read, secretary and treasurer.

Illinois State Electric Association.—The dates for the convention of the Illinois State Electric Association at the Hotel La Salle, Chicago, have been changed to Oct. 23 and 24. This change was made to arrange a convenient overlap with the convention of the Illuminating Engineering Society, which will be held in Chicago from Oct. 21 to 24. The Chicago Electrical Trades Exposition will be in progress during both of these conventions.

American Institute of Mining and Metallurgical Engineers.—The iron and steel industry will be one of the subjects to receive particular attention at the Chicago meeting of the A. I. M. and M. E., which is to be held from Sept. 23 to 26. Trips by the institute as a body to the zinc-smelting districts, the steel works at Gary and the refineries at Whiting and East Chicago have been arranged. Charles M. Schwab is announced as one of the speakers at the banquet to be held on Sept. 24.

Pennsylvania Electric Association.—Sept. 3 to 6 is the date set for the twelfth annual convention of this association, which will meet at Bedford Springs, Pa. Addresses are to be given by Governor William C. Sproul of Pennsylvania, William D. B. Ainey, chairman of the Pennsylvania Public Service Commission, and W. H. Johnson, vice-president of the National Electric Light Association. The following papers are also to be presented: "The Effect of the War on Boiler-Room Practice," by John A. Barnard, combustion engineer, Philadelphia Electric Company; "Economical Boiler-Room Practice for Medium-Sized Plants," by H. B. Bryans, engineer Counties Gas & Electric Company, Norristown, Pa.; "Selecting a Switchboard for a Plant of Moderate Size," by G. E. Wendle, assistant general manager Lycoming Edison Company, Williamsport, Pa.; "Management and Men," by W. H. Forster, vice-president Independence Bureau, Philadelphia, Pa.; "Increasing Capacities of Existing Lines and Cables," by E. C. Stone, system operator Duquesne Light Company, Pittsburgh; "The Story of Insulations," by C. E. Skinner, engineer research division Westinghouse Electric & Manufacturing Company, Philadelphia; "Meter Department Practice in a Large Scattered Territory," by E. H. Tyson, superintendent meter department Lehigh Valley Light & Power Company, Allentown, Pa.; "Isolated-Plant Costs as Influenced by the War," by John Meyer, Philadelphia Electric Company, and "Power-Factor Correction by Means of the State Condenser," by O. C. Roff, General Electric Company, Philadelphia.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Hydroelectric Power in Formosa.—A project to develop hydroelectric power from the Ditugettan River in Formosa is reported. A corporation was formed with $15,000,000 capital, of which nearly one-half is owned by the local government. The stock offered for public subscription was enormously oversubscribed.

Little Trouble from Lightning in Georgia.—During this summer's electrical storms the Georgia Railway & Power Company reports less station trouble than in any previous summer. This is attributed to the fact that all machines have been inspected at frequent intervals and their operating condition kept up to the highest point.

Examination for Junior Electrical Engineer.—The United States Civil Service Commission announces an open competitive examination for junior electrical engineer, for men only. Vacancies in the Bureau of Mines, Department of the Interior, for duty at Pittsburgh or elsewhere, at $1,080 to $1,200 a year, with temporary increase of $240 a year granted by Congress, if services are satisfactory, and in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion. Competitors will not be required to report for examination at any place, but will be rated on the following subjects, which will have the relative weights indicated: Physical ability, 10; education and experience, 80.

Potomac Edison Company Formed.—The Potomac Edison Company has been incorporated to take over and to develop various properties in West Virginia and Maryland. The company will have a capitalization of $4,000,000 first mortgage bonds, $1,700,000 second mortgage bonds, $1,000,000 preferred stock and $3,500,000 common stock. It will take over the present properties of the Edison Electric Illuminating Company of Cumberland, Cumberland Electric Railway Company, West Virginia Central Gas Company, West Virginia & Maryland Gas Company (of Maryland), West Virginia & Maryland Gas Company (of West Virginia), Maryland Gas Company, Hartland Power Company, and all of the electric light and power companies doing business in Grafton and vicinity. The company expects to begin work at once on extensive electric power developments covering the entire territory between the properties acquired in Maryland and West Virginia. A large power plant will be built in proximity to the coal mines and used to supply the entire section. The new company has been completely financed and will take over the above properties and begin new improvements about Sept. 15.

Electric Strike in Upper Silesia.—One of the most serious strikes in Upper Silesia broke out at Chorzow and Sarborz, where the electric light workers walked out on July 27. The artificial lighting of the entire province was cut off and coal mines and other industries that depend upon electricity for light and power were threatened.

To Electrify Belgian Railways.—The Minister of Railways has approved the project of the electrification of Belgian railways, and plans for the line connecting Brussels and Antwerp and Brussels and Luxemburg have been submitted. Work will be commenced at the beginning of 1920, and the journey between Brussels and Antwerp will be made within twenty-five minutes with trains every fifteen minutes.

Safety Meetings in Business Hours.—At a meeting of the central committee on safety of the Public Service Company of Northern Illinois it was decided that hereafter "safety first" meetings should be held during business hours instead of as formerly in the evening. It was considered that a larger attendance of employees could be secured by fixing the meeting hours at this time and thus knowledge of up-to-date safety methods approved by the company's safety organization be more generally spread. It was also decided that meetings of intermediate committees should be held periodically in each division. Each intermediate committee on safety is to consist of the division superintendent as chairman, the secretary of the central committee on safety as secretary, and the chairman of the division of employees' safety organization and heads of virtually all departments.

Georgia Company Changing 11,000-Volt Lines to 38,000 Volts.—With the changing over of the Newnan-Carrollton (Ga.) line, on Sunday, Aug. 3, from 11,000-volt to 38,000-volt operation, all of the former low-tension lines on the system of the Georgia Railway & Power Company in Georgia will be operating at 38,000 volts, except the Boulevard-Gainesville line. As soon as that can be reinsulated it also will be converted to the higher voltage. "When this line is changed over, it will leave us with nothing outside of Atlanta with less than 38,000 volts," said T. F. Johnson, superintendent. "We have been working on all these changes more or less steadily for the past three years or more and are just now completing the job. The purpose of putting them on higher voltage is to enable us to pull more load, the demand on them having grown heavier than they were designed originally to carry. This process will not have to be repeated, however, as all the new lines we are building are designed to go to the ultimate higher voltage of 38,000."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Franchise Contracts with a City.—Where a municipality, as a condition to granting a franchise, contracts as to the rates to be charged by an electric light company, it is acting in its business and not in its governmental capacity, according to the Supreme Court of Appeals of Virginia (99 S. E. 723).

Injuries to Trespasser.—Where a boy swam across a canal, climbed upon defendant's property, walked to end of plank, and was killed by falling electric wires while preparing to dive, the Supreme Court of New York (175 N. Y. S. 795) has held that defendant was not liable, since deceased was a traspasser, although the end of the plank extended beyond defendant's boundary line and it did not appear that the plank was the defendant's property.

Right to Use Streets for Service Lines.—Right to use streets for the purpose of transmitting electric energy thereon for the use of the inhabitants may be granted by a municipal corporation to a public service corporation organized for the purpose, and when this is done such public service corporation will have the same rights in the public streets for such purpose as the city would have had it undertaken the work itself, according to the Supreme Court of Appeals of West Virginia (99 S. E. 478).

Failure to Guard Exciter.—An employer operating an electric power plant is not negligent in failing to fence an exciter which is covered with a shield, leaving no exposure except openings for adjusting and cleaning machine, where other employers in same line of business did not fence in exciters by guard rails, and where employee who came in contact with machine was experienced and familiar with the surroundings, according to the Commission of Appeals of Texas (212 S. W. 656).

Irrevocable Rate Contracts.—The Supreme Court of Appeals of Virginia has pointed out (99 S. E. 723) that as Section 125 of the constitution must be construed with Section 164, the latter section, providing that the right of regulation and control of public service corporations shall never be surrendered or abridged, does not prohibit municipal corporations from making irrevocable contracts as to rates on the condition of granting a franchise to public service corporations, as electric light companies, and hence corporation commission, under the act of 1914, has no authority to change without consent of such municipalities rates so fixed.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. S. Robertson has been made assistant general manager of the Nebraska Power Company and will have charge of operation.

O. A. Rofelty, manager of the Sioux Falls (S. D.) division of the Northern States Power Company, has recently been elected president of the South Dakota Electric Power Association.

L. P. Chaney, formerly chief engineer of the power station of the Pensacola (Fla.) company, has been appointed in a similar capacity with the Blackstone Valley Gas & Electric Company, Pawtucket, R. I.

C. E. Michel, who in March of this year was appointed sales manager of the Union Electric Light & Power Company, St. Louis, Mo., will in addition give part of his time to the merchandising activities of the Milwaukee Electric Railway & Light Company. Since joining the organization of the St. Louis company Mr. Michel has had a very successful career in central-station commercial work, gaining for himself a wide reputation for the original methods he has worked out in investigations conducted in electric vehicle and electrical appliance work.

C. E. MICHEL

Robert N. Hodgson, heretofore general manager of the Binghamton (N. Y.) Light, Heat & Power Company, has resigned to accept another position with the W. S. Barstow interests. Mr. Hodgson's new position will be that of sales manager of the W. S. Barstow Management Association, which controls the Binghamton Light, Heat & Power Company and twenty-two similar companies. His headquarters will be in New York and he will have charge of the commercial end of the association's business.

D. C. Hopper has accepted a position with the Newport News & Hampton Railway, Gas & Electric Company. Previous to the war Mr. Hopper was with the Commonwealth Edison Company of Chicago as assistant superintendent of underground cable system, and since that time he has been in charge of the electric distribution and signal systems of the American International Shipbuilding Corporation.

Capt. Jas. H. McLaughlin, formerly connected with the Baton Rouge (La.) Electric Company, has gone to Houston, Tex., as secretary to L. G. Bradley, vice-president of the Houston Electric Company.

H. R. Sharpless has been appointed chief engineer for the Pensacola (Fla.) Electric Company. Until recently Mr. Sharpless was chief engineer for the power station of Baton Rouge (La.) Electric Company.

Frank M. Eastman has been appointed superintendent of the Montpelier & Barre Light & Power Company at Montpelier, Vt., taking the place of Charles J. Cookson, who has been promoted to manager.

W. A. Hiddleson, formerly general manager of the Central Service Company at El Campo, Tex., has been appointed general manager of the Bristol Gas & Electric Company and Wautauga Power Company at Bristol, Tenn.

W. H. Clarke, formerly manager of bond department of H. M. Byllesby & Company, has been appointed vice-president in charge of the taking over of new properties. Joseph H. Briggs now becomes manager of the bond and securities department.

H. G. Barnes has been appointed superintendent of the Edison Electric Illuminating Company at Whitman, Mass. He takes the place of Martin Bockopen, who has been acting superintendent for the past few months. Mr. Bockopen returns to the Brockton office of the company.

R. L. Peterman, superintendent of the Pennsylvania Utilities Company, a property under the management of the W. S. Barstow Management Association, has been made general manager of the Binghamton Light, Heat & Power Company to take the place made vacant by the promotion of Robert N. Hodgson to be sales manager of the W. S. Barstow Management Association.

E. J. Horrigan, who has been appointed local manager of the Taunton (Mass.) municipal lighting plant, is a graduate of mechanical engineering of Brown University. After having been graduated in 1915 he was associated with the Blackstone Valley Gas & Electric Light Company at Pawtucket. Then for a year he was efficiency engineer of the Glenlyon Dye Works at Saylesville, R. I., and later master mechanic and mechanical engineer for the same plant. For several months he was in the national service as mechanical expert in the United States Navy on foreign duty, and very recently he was associated with Warren B. Lewis of Providence, a consulting engineer.

W. B. Goudey, electrical engineer with the Binghamton (N. Y.) Light & Power Company, has been made assistant to the general manager. This is a new position created in the Binghamton company. Mr. Goudey will assist Mr. Peterman, who has been recently appointed general manager of the company.

Edward N. Lake, who was formerly manager of the Krehbiel Company, consulting engineers, Chicago, and who prior to that time was resident engineer with Stone & Webster, is now president of the Lake Engineering Company. During the war Mr. Lake resigned from the Krehbiel Company to enter the United States Army, where he served as a major in the construction division, Quartermaster's Corps. The majority of Major Lake's time in the army was devoted to the work of the construction division at the Scituate Proving Grounds, Scituate, Mass.

E. N. LAKE

Dorsey R. Smith has been selected by the managers of the Consolidated Gas Electric Light & Power Company, Baltimore, Md., to head its merchandise and domestic sales department. Since entering the employ of the company more than fifteen years ago Mr. Smith has filled successfully several positions, the first one being that of an outside salesman selling gas-consuming appliances. When the gas and electric companies merged under the name given above, he was placed in charge of the incandescent lamp department of the electric division. Six years ago, when the Consolidated Gas, Electric Light & Power Company decided to broaden out and inaugurate a merchandising business of gas and electric appliances, table lamps and the like, Mr. Smith was chosen as assistant to the manager of the company's merchandise department.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

ELECTRIC HEATING DEVICES AGAIN ADVANCING IN PRICE

Lists This Week Put 6-Lb. Irons at from $6.75 to $7.25, Although New Schedule Prices Are Not Expected Till Next Month

Electric heating and cooking devices are again advancing in price in spite of the efforts that have been made from time to time by the trade to bring about a reduction. Early this week a couple of manufacturers brought out new price sheets, and it is known that another of the larger manufacturers is planning to do so in a few days. Furthermore, it is known that a new set of license prices is now virtually ready and will probably be put into effect some time the latter part of September.

At the conclusion of the war there was a strong representation, particularly from the electrical supply jobbers, that prices throughout the lines of electric heating and cooking devices were too high. However, so far as can be learned, there has been no let-up in consumer demand, and the market for these devices, together with other household devices, has gone a long way toward keeping many jobbers in a prosperous condition.

At the writing of this report it could not be learned definitely just what conditions had been responsible for the higher prices, but it is not unreasonable to suppose that the condition of labor supply and wages was largely responsible.

While none of the schedule prices has yet been announced by the supervisor of the patent, the new lists of those manufacturers announcing prices this week put 6-lb. irons at from $6.75 to $7.25. These irons had been listed at $6.50.

STEEL POLE AND TOWER MARKET SHOWS IMPROVEMENT

Domestic and Foreign Fields Expanding—Galvanized Work Higher—Shipments Lengthening and Expected to Become Longer

Business in the steel-pole market is becoming better and is showing much improvement over the volume of buying done in the spring. Combination trolley and lighting poles are in better demand in the domestic market. Orders are well scattered throughout the country and are in better volume per order. Foreign orders are coming in in a more favorable manner and the character of the inquiries is becoming better. Several countries in Europe, the East Indies, South America and Mexico are at present in the market for steel poles.

Prices on the rolled-steel poles have been reported steady on account of contracts now held. Steel pipe has advanced in price, so it is expected that when these contracts run out the price on the poles will advance. Pipe factories are working to capacity with the heavy ordering for the oil fields, and shipments on hollow steel poles are consequently lengthened. The shipments run from four to twelve weeks depending on how close to the time of rolling an order comes in.

Fabricated and expanded poles are on a shorter shipment schedule at this time, more in the neighborhood of two to four weeks. Increased buying of structural steel, however, is expected to lengthen time of shipments. There has been no price advance reported for this class of pole.

Steel tower business is 10 to 20 per cent of normal, according to manufacturers. The domestic orders are showing more activity as regards number of orders, but the size of the orders is still small. Companies which would normally order 2000 towers are ordering only 200. Activity is shown on the Pacific Coast, in the Central States and in the East, where the larger holding companies are putting through extensions to transmission lines. Orders and inquiries for foreign consumption are on the increase and much improvement is expected in that direction. There is hardly a European country but has plans under way for large extensions and developments of hydroelectric properties and transmission.

Prices on these fabricated towers have increased 10 to 15 per cent with increases in the price of spelter for galvanizing and the condition of the labor market. Shipments are reasonable at this time, but are expected to become longer with the steadily increasing demand for structural steel.

ELECTRIC ELEVATOR PRICES ARE TO BE INCREASED

Manufacturing Costs Have Advanced and Heavy Requirements of New Buildings Are Supplemented by Demands to Replace Hydraulics

The low operating cost of electric elevators is creating an extensive demand for them to replace hydraulic elevators, which cost roughly twice as much to run under present conditions. This business, coupled with that obtained for new buildings being constructed, is responsible for the fact that one of the largest manufacturers in the country has more freight and passenger elevator business on its books than ever before in its history. Other manufacturers are also busy. The reduction in unit overhead expense resulting from increased production is more than counterbalanced by increased wages to labor and the increased cost of copper and other materials. The prices of electric elevators may therefore be expected to go higher. Deliveries are now averaging about two months, but the time varies, however, from about five or six weeks for small freight elevators up to from three to five months for high-speed gearless machines.

BRAZIL AS A MARKET FOR ELECTRICAL APPARATUS

German and Swiss Pre-War Trade with This South American Nation Was Large—Use of American Fuses Increasing

Owing to the extensive sale of German and Swiss motors and switchgear, the German type of gear had a considerable market in Brazil just prior to the war. There is nothing to be said in their favor except, from the manufacturers' point of view, that the client once having purchased them is obliged to replace them from their original source, as they were not manufactured to any international standard, according to the report to the British Electrical and Allied Manufacturers' Association by John M. Glen of Rio de Janeiro.

The report states that American types of fuses, built to American standards, capacities and sizes, have since so well replaced the German fuses they have undoubtedly

come to stay. The British practice of wire fuses protected in porcelain handles, it is stated, has no market whatever in Brazil. The author is very careful to state that in countries like Brazil, where electrical machinery is often handled by inexpert persons, it is better that no latitude be left as regards the replacement of the fuses. He furthermore points out that there is a considerable market in Brazil for standard-size plug fuses for use with the American type light fixtures.

METAL MARKET SITUATION

Copper Much Stronger—Outside Stocks Low and Prices Rise to ½ Cent Below Producers' Price

The copper market is showing renewed activity, and prices are becoming firmer. The outside market has come up to within ½ cent of the producers' prices and has steadied considerably. Producers are continuing their price of 23.50 cents for August and September and in some cases are extending their price to October. Most of the producers, however, are holding for 24 cents to 24½ cents for the last quarter. Their desire not to sell for last-quarter delivery is pretty well shown in the price they quote. Second hands will cut these August and September prices by ½ cent and the last-quarter prices by ½ cent under the 24 cents of the producers.

The seconds have pretty well used up their stocks of copper and are returning to roost with the producers and await with them the next buying movement. Little, comparatively, has been bought for late fall delivery, and producers expect that this movement should start in again in a few weeks. Buying at the end of last week was on the increase, but right now it is rather quiet.

Standard spot copper in the London market has strengthened over £8, to £100 15s. Export buying is improving but is still below its expected proportions. This is likely to be the case until satisfactory credit and exchange conditions have been worked out. European needs are still high on wire bar and are growing more pronounced.

Copper wire at the mill has declined 1 cent, to 25 cents net, while copper and brass sheets, tubes and rods have advanced 1 cent. Round-copper rods are 30.25 cents, high brass sheets and wire are 27.75 cents, and seamless copper tubing is 37.50 cents.

Nickel is quoted up 1 cent, to 41 cents a pound.

Zinc has stiffened to 8 cents and the market is stronger. There is better inquiry from consumers, but apparently little anxiety to sell on the part of either dealers or producers. The disposition is better, however, to sell for the last quarter. On account of the lifting of the embargo there is a more satisfactory movement of zinc.

The copper and brass scrap market has strengthened ½ cent, and there is little activity present.

NEW YORK METAL MARKET PRICES

	Aug. 12	Aug. 20
Copper:	£ s d	£ s d
London, standard spot	92 5 0	100 15 0
	Cents per Pound	Cents per Pound
Prime Lake	22.25 to 22.75	23.50
Electrolytic	21.50	23.00
Casting	21.00	22.12½
Wire base	26.00	25.00
Lead, trust price	6.00	6.00
Antimony	9.00	8.75
Nickel, ingot	40.00	41.00
Sheet zinc, f. o. b. smelter	10.50	10.50
Spelter, spot	7.65	8.00
Tin	70.00	60.00
Aluminum, 98 to 99 per cent	31.00 to 33.00	32.00 to 33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	18.00 to 19.00	18.00 to 18.50
Brass, heavy	10.00 to 10.50	10.50 to 11.00
Brass, light	9.00 to 9.50	9.00 to 9.50
Lead, heavy	5.12½ to 5.25	5.00 to 5.10
Zinc, old scrap	5.25 to 5.50	5.00 to 5.25

THE WEEK
IN TRADE

THE markets for electrical supplies in different parts of the country are varying in character. The East, West and South are enjoying a good jobbing trade, while the Middle West and Northwest are running at a slower pace. Labor troubles account for this to some extent. Domestic appliances of all kinds are holding an especially good market, and wiring devices and materials are fast coming to the fore. Deliveries are no better in general and are growing longer in specific cases.

Building of residences in the West is increasing to better degree than that for business purposes. As a whole, though, all classes of building are expanding. Collections are reported in a satisfactory condition.

NEW YORK

Satisfactory reports are being received as to business conditions in the supply jobbers' field. Some jobbers of course do better business than others, which accounts for a lighter business from some quarters. That general wiring conditions are looking up is shown by better movements in rubber-covered and weatherproof wires, rigid conduit and its fittings, and schedule material. No jump in demand has been noted in these articles, but the general market has continued to show an upward trend.

Strikes among transportation employees have already begun to slow up deliveries of supplies from New England points in particular. Street-railway strikes are under way in several cities, although the one on Manhattan Island was short-lived. Labor is so unsettled and so flushed with concessions from many sides that there is hardly a trade that is not in a state of unstable equilibrium, ready to flop over into a strike on a moment's notice. Complete cessation of all building activities in New York City on the part of the builders is predicted as a result of the action of the various organized trades unions in their concerted, constantly recurring rotation of strikes.

Prices in general have been pretty well maintained this past week and few changes have occurred. Table heating ware has increased, as have fir cross-arms.

HEATING WARE.—The end of last week heating ware advanced in price in varying amounts. Of these advances, 6-lb. irons went up from 25 to 75 cents, ordinary toasters 25 cents, three-heat grills $1.50 to $2.50, and percolators from 50 cents to $2.25.

SCHEDULE MATERIAL.—Sales are in better volume, and deliveries in some cases are much behind.

FANS.—Sales are rather light with just an intermittent demand. Stock in some jobbers' hands is low, while in others it is rather high because of delayed deliveries from manufacturers. In this latter case sizes are well diversified.

FUSES.—Sales are in good volume with a better leaning toward the renewable cartridge and the regular plug type. The demand has been characterized as quite normal.

FLASHLIGHT BATTERIES.—A good summer business has been done, and from some quarters jobbers have reported refusing orders on account of poor deliveries.

FLEXIBLE NON-METALLIC CONDUIT.—The market is quiet with better sales reported to private plants.

CROSS-ARMS.—From one source prices advanced 20 per cent Aug. 16. From another source comes an advance of 10 per cent in price on fir cross-arms in less than carload lots with a withdrawal of all prices on carload lots and over.

HEATING ELEMENTS.—In the manufacture of celluloid articles and in the candy, hatting, printing and paraffining trades these elements are being adopted to an increasing degree.

HEATERS.—Some orders are already being placed for fall stocks of heaters, and more prominence has been given to these in store windows.

CHICAGO

Prices are still going up, and retailers have difficulty getting sufficient merchandise. The extravagant consumption of goods in this country, however, makes for shortage abroad, and it is beginning to be recognized in this section that speculation and over-trading are producing an unhealthy economic situation. Business in the electrical trade is suffering from the many strikes and lockouts throughout this territory. In spite of the tie-up in the building trades permits were issued last week in Chicago for four apartments. New building projects announced in Chicago during the week exceeded $4,000,000. Building is proceeding at top speed in Minneapolis. There are very general complaints on account of the slow freight service from the East, especially in l.c.l. shipments. This was before the embargo, which makes matters considerably worse.

WIRE.—Practically every one is quoting a 30-cent base for rubber-covered wire this week, though there is little or no stock of the smaller sizes in Chicago. The base on weatherproof wire is 28 to 29 cents, with 27 cents base quoted for bare wire. The stocks of weatherproof wire are a little better than the supply of rubber-covered. There is not much demand for bare wire at the present time.

RIGID CONDUIT.—Jobbers' stocks are adequate for present business, but it may be difficult to replenish these stocks because the pipe mills are making more of the oil line sizes than of the smaller conduit sizes.

POLE-LINE HARDWARE.—There is a steady demand for this material, which the jobbers are in most instances able to supply from stock. The prices are firm.

HEATING APPLIANCES.—More than one manufacturer expects to put a higher-priced schedule into effect before this issue reaches the reader.

LAMPS.—Business is good and factory deliveries are satisfactory. The C-4 lamps are in the hands of the agents, but no reports of their sales are yet available.

MARINE FITTINGS.—One manufacturer reports excellent business. Deliveries of the types in most demand are being made from stock.

HIGH-TENSION INSULATORS.—The market for 33,000-volt insulators is very active, and there is also some call for 66,000-volt insulators. There is extensive new line construction in Wisconsin, Indiana and Arkansas.

AUTOMATIC TELEPHONES.—The volume of business is very good, and one manufacturer is increasing his factory capacity to meet the demand. One order for over $250,000 was closed last week.

SMALL MOTORS.—One manufacturer reduced the price of his 1-hp. and 2-hp., three-phase motors by about 10 per cent on the first of this month.

HIGH-TENSION TRANSFORMERS.—There is a growing demand for small high-tension transformers for use with precipitation processes. The 10-kva. size wound for 85,000 volts is the most popular; 100,000 volts is sometimes used, but the tendency is toward 50,000-volt units.

BOSTON

Business is extremely brisk in jobbing circles. The railroad embargoes were lifted Monday, following the return of most of the striking shopmen. The interruption of steam transportation slowed down deliveries considerably, but by and large the jobbers' stocks were sufficient to carry the trade through the fortnight of curtailed train service without serious annoyance. Jobbers are now buying heavily in anticipation of the fall trade, especially in pipe and wiring material. Prices are still moving upward. Important advances noted within the past few days include heating equipment for domestic service, porcelain knobs, tubes and cleats, non-metallic flexible conduit and switch boxes. Manufacturing plants in New England are very active, barring interruptions caused by labor trouble. Street-railway strikes are causing business much annoyance, and extensions of these are threatened in eastern Massachusetts. Collections are in excellent shape. Jobbers are short of some classes of wiring material, but in the main the requirements of current building operations are being met with promptness. Retail trade, while good, is running below the expected fall demand.

MOTORS.—The demand is highly diversified and motors up to 50-hp. rating are being ordered freely. Small single-phase motors are widely sought, and manufacturers are hard pressed to meet the demand. Prices are steady, with no immediate changes in sight.

APPLIANCES.—Flatirons are moving well and stocks are maintained only by steady buying. One manufacturer marked up his prices Monday on irons an amount of 75 cents, on grills $2.50 and on toasters 50 cents.

LAMPS.—Some sales are being made, especially for gifts. Stocks are well prepared for the fall trade. Portable lamps have moved freely this summer. No more complaints are being heard as to shortage in smaller-sized units.

FANS.—Little demand for fans is to be seen at present, but remaining stocks are being mobilized on the retail counters for fall buying. One or two hot waves would pretty nearly exhaust the supply. It is not believed that many fans will be carried over this year.

POLE-LINE HARDWARE.—A fair business is being handled, but it is not difficult to keep stocks up to normal in the face of the existing moderation in central-station line construction. Prices show little change.

WIRE.—Prices are steady at a 30-cent base for rubber-covered wire and about 27 cents for bare. Smaller sizes are reported to be growing scarcer. Building operations are taking more and more of this material.

RIGID CONDUIT.—Heavy orders are being placed with the manufacturers. The mills are finding difficulty in falling behind still farther in deliveries. Prices of Card No. 43 are still in effect, but there are rumors of another advance before long. Stocks are running low, especially in the smaller sizes.

SWITCHES AND SOCKETS.—Trade is brisk and local stocks are maintained with some difficulty. One manufacturer is far behind on orders for pull-chain sockets. Prices are firm, with no immediate prospect of change. Labor troubles in lower Connecticut are hurting deliveries in various lines, and the need of increased production is widely appreciated in the trade.

NON-METALLIC FLEXIBLE CONDUIT.—Prices have risen about 20 per cent in the past fortnight. This material is relatively scarce and in much demand.

KNOBS, TUBES AND CLEATS.—Stocks are close to the bottom of the bin. Prices increased about 10 per cent within the week.

ATLANTA

All lines continue active, with a corresponding swell in the total volume of business being transacted. Orders for substantial quantities of electrical materials are coming in from all sources, and manufacturers are all experiencing considerable difficulty in getting shipments through on predetermined delivery promises. While the railroad shopmen's strike of last week threatened to tie up freight transportation facilities in the Southeast, reports at hand indicate that little inconvenience was felt, with the exception of small shipments to outlying points. On the whole, prices remain steady and shipments are growing longer. Collections are good. Construction on all types of buildings continues to expand.

IRONS.—The market is active; shipments are slowing up. It is rumored that prices will advance 50 cents per unit.

STAMPED-STEEL BOXES.—Sales show a gradual increase over the previous few weeks. Prices are firm. Local stocks are in fairly good condition.

FLEXIBLE STEEL CONDUIT.—Trade is brisk, showing an improvement over last week. Southeastern stocks are ample and deliveries are prompt.

PANELBOARDS.—A brisk movement is observed, with accompanying steady prices. Factory shipments are being made on standard equipment from ten days to two weeks.

OIL CIRCUIT BREAKERS.—Manufacturers report a big demand for the smaller capacities from industrials, and especially the textile field, to be used in connection with individual and four-frame drives. The business has been increasing steadily for the last few weeks. No change has been noted in prices. Manufacturers are shipping in three weeks.

WIRE.—Following the hectic conditions of last week, prices are comparatively steady on both weatherproof and rubber-covered. Southeastern stocks are 25 per cent below normal and factory shipments are longer. A shortage for No. 14 rubber-covered exists. Eastern shipments are promised in ten weeks.

MOTORS.—Seasonal demands in the cotton and allied industries have brought up total sales for capacities of 100 hp. and 150 hp. The rush on factories to get out this apparatus has tended to further lengthen shipment promises. As a rule, fair stocks of sizes up to 75 hp. can be drawn upon to take care of quick deliveries.

CONDUIT.—Prices are steady in the face of a heavy call from all sections. Carload lots from Eastern points are promised for three weeks. Local stocks are being rapidly replenished.

STEEL-ARMORED CABLE.—Manufacturers and jobbers report a very active market. Local stocks are depleted. This condition, together with uncertain factory shipments, makes for an unsettled situation with regard to local delivery promises. Prices have not changed recently.

TRANSFORMERS.—Distributing types up to 100 kva. are moving swiftly, keeping pace with the present construction boom. Manufacturers' stocks throughout this section are in excellent shape to handle the heavier volume of business expected this coming fall. The call for power type compares favorably with the past month.

METERS.—The 5-amp. residence type is going fast. Sales to municipal plants and private central stations are increasing in volume. Stocks are ample. Early shipments for stock have put the manufacturers in an enviable position as regards deliveries, and the recent freight tie-up had little effect in curtailing this item.

SAN FRANCISCO

Business in all its electrical phases is reported good. Staples are ordered in ever-increasing quantities because of liberal freight inducements. There is a tendency, on the other hand, to reduce the maximum quantities of certain specialties, such as vacuum cleaners, sewing machines, motors and vibrators, as necessary to get the best prices. Local stocks are in bad shape, being rather spotty because of labor conditions in the contributing Eastern factories. Canneries are running full blast with the biggest yields of many years. Labor conditions are quieter, but a local committee recently drafted a shipyard wage scale to remain effective for several years. The operating crews of the two principal southern California electric roads are out on strike. The Mare Island Navy Yard will be completely remodeled, with a large amount of housing and resulting business as a consequence.

RANGES.—Contrary to popular opinion, the recent range price advance has not blotted all range business, for many orders are reported.

TOOLS.—With factory shipments on the way, a great amount of tool business that was jammed up by non-supply is recorded. New line construction and necessary repair work are causing a big demand for construction tools such as spoons, shovels and pike poles.

RUBBER-COVERED WIRE.—No less than four rubber-covered wire changes have occurred during the past few weeks. The Coast is practically drained of house-wiring sizes. Predictions are that special types of rubber-covered wire, or types that are now considered more or less special, will be more freely specified, and Eastern factories are placing men on the Coast to handle such business authoritatively.

SCHEDULE MATERIAL.—Some big orders for sockets and receptacles were received during the past week and from their size indicate, first, a belief that prices will jump, and, second, an assurance that necessary new building will soon begin.

CONDUIT.—No big specifications are afloat, but very many small jobs requiring sizes ½-in. to 1-in. inclusive are secured. An increasing amount of manufacturing on the Coast with motor-driven machines requiring adequate protection is causing an increased demand for flexible metallic conduit.

HEATING MATERIAL.—House appliance business has been greatly stimulated, particularly in the larger devices. An interesting reflection on these conditions in the smaller devices is the very marked increase in the sales of small disk stoves, grill stoves, etc.

SEATTLE—PORTLAND

The optimistic impression which prevailed early in the summer among electrical jobbers that better business would materialize by mid-summer—in fact, that sales volumes would approximate war-time conditions—has been proved unwarranted and very much exaggerated. Shipyards and industrial plants allied with shipbuilding are buying only as needed and are making no definite preparations for the future. The future of shipbuilding in the Northwest is very uncertain.

Jobbers in Seattle during the past week reported sales very light. This condition is true of every large city in the Puget Sound district. Shipments are coming through sufficient to maintain stocks. There was no increase in prices during the week. Dealers, on the other hand, report a comparatively active week. Sales of house-wiring devices, domestic appliances and electric tableware were very satisfactory, ranges moved considerably faster, and a considerable increase in buying of portable lamps and high-grade fixtures was noted. Gray's Harbor district reports that building conditions show much improvement. Tacoma reports further increase in residence building, as does Portland. Seattle building continues active, particularly along residence and small-business lines. Regarding big-business buildings, there seems to be a tendency to defer action pending lowering of material prices and settlement of labor unrest.

VACUUM CLEANERS.—Recently Eastern shipments were received in Seattle in time to prevent a shortage in several lines. Those who placed advance orders are receiving small monthly quotas. Sales all summer have been exceptionally good, although dealers reports last week showed a slight decrease in number sold.

HARDWARE.—Although prices have remained fairly steady of late, the general market is in an expectant attitude and transactions of much moment are quite scarce. Buying in small lots is well sustained, and sales volumes, according to more optimistic jobbers, are all that can be expected at this time. Stocks are good.

RUBBER-COVERED WIRE.—The demand during the past few weeks has been light and from present indications will not increase materially. The shipyards, the biggest consumers, are buying as needed. Local stocks are in good shape.

MOTORS.—Deliveries are good, far in excess of present demand, and stocks are in excellent shape. This applies particularly to larger sizes, for which demand is inconsiderable. The demand for fractional sizes and for sizes ranging from 1 hp. to 10 hp. during the past three weeks has been healthy. Prices show no notable increase over previous quotations.

PORTABLES.—Sales are far in excess of corresponding period last year. Stocks are in good shape and prices remain comparatively steady.

SCHEDULE MATERIAL.—Seattle jobbers especially report noticeable increase in demand with sufficient stocks to handle increasing business. Prices are firm.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

Armored Conductor, Flexible Steel

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
No. 12 Solid	
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

Twin-Conductor

No. 14 Solid	
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
No. 12 Solid	
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	
Less than coil	List
Coil to 1000 ft	5%
No. 12 Solid	
Less than coil	Lis
Coil to 1000 ft	5%

Twin-Conductor

No. 14 Sblid	
Less than coil	$90.00 to $100.00
Coil to 1000 ft	85.00 to 82.50
No. 12 Solid	
Less than coil	List
Coil to 1000 ft	5%

Attachment Plugs

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to list
1/5 to std. pkg	List to 20%
Std. pkg	23% to 36%

Batteries, Dry

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.40	.40
50 to barrel	.36	.37
Barrel lots	.329	.339

Batteries, Dry—*Continued*

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

Conduit, Metallic Flexible

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
1	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00 to 109.00	93.00 to 95.00

Conduit, Non-Metallic Flexible

Size, In.	List per Foot	Size, In.	List per Foot
⅛	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1½	.47
⅝	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅛-in.—	$35.00	$27.50	$26.50
¼-in.—	35.00	30.00	29.00

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
⅛-in.—	$48.00	$24.50–27.75	$22.50–30.50
¼-in.—	$52.00–53.00	26.50–30.50	24.75–28.25

Conduit, Couplings and Elbows, Rigid Iron

Card No. 42

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
¾	.17
1	.23
1¼	.27½
1½	.37½
2	.58½
2½	.76½
3	

Conduit, Couplings and Elbows, Rigid Iron—*Continued*

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
¾	.13	.37
1	.17	.45
1¼	.21	.50
1½	.28	1.10
2	.40	1.80
2½	.60	4.80
3		

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	1% to 12.1%	3% to 14.1%
2500 to 5000 lb.	6% to 15.1%	8% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3% to 3.1%	2% to 2.1%
2500 to 5000 lb.	+1% to 5.1%	4% to 7.1%

(For galvanized deduct six points from above discounts.)

Flatirons

NEW YORK

List price	$6.50 to $7.50
Discount	25%

CHICAGO

List price	$6.50 to $7.50
Discount	25% to 30%

Fuses, Inclosed

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

Fuse Plugs

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

Lamps, Mazda or Tungsten

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

Lamp Cord

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$28.60–$35.01
Coil to 1000 ft	25.74– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$23.00–$32.00
Coil to 1000	23.00

Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

Outlet Boxes

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	33%–40%	24%–32%
$10.00 to $50.00 list	45%–50%	32%–43%

Pipe Fittings

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

Porcelain Cleats—Unglazed

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$17.85 to $22.40
1/5 to std. pkg	14.70 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$17.85–$24.15
1/5 to std. pkg	14.70– 21.00

Standard pkg., 2200. List per 1000, $20.00 to 21.00

Porcelain Knobs

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid	Nail-it—N.C.
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg	10.50– 11.20	15.35– 18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid	Nail-it—N.C.
Less than 1/5 std. pkg	$13.60–$18.40	$27.20–$36.80
1/5 to std. pkg	11.20– 16.00	22.40– 32.00

Sockets and Receptacles

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20 to list
1/5 std. pkg	List to 10%

Switches, Knife

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

Switches, Snap and Flush

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	23%

Switch Boxes, Sectional Conduit

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 33%	24% to 25%
$2.00 to $10.00 list	30% to 33%	24% to 25%
$10.00 to $50.00 list	30% to 45%	25% to 36%

Toasters, Upright

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$7.00
Discount	25% to 30%

Wire, Annunciator

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.52
No. 18, full spools	.51

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.54 to $0.57
No. 18, full spools	.48 to .51

Wire, Rubber-Covered, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$16.00	$13.00	$13.00
12	21.78	21.78	18.15
10	31.18	27.67	22.64
8	42.12	38.77	31.64
6	61.16	55.60	50.04

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25.00	$14.00	$14.00
12	30.00	19.00	19.00
10	35.77	35.77	30.66
8	42.84	42.84	36.72
6	67.80	67.80	56.50

Wire, Weatherproof

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$34.00
25 to 50 lb	34.00
50 to 100 lb	33.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$30.75
25 to 50 lb	30.75
50 to 100 lb	30.75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Plug Cut-Out

The Arrow Electric Company of Hartford, Conn., is now manufacturing the line of plug cut-outs shown in the accompanying illustration. These

PLUG CUT-OUTS RATED AT 30 AMP. AND 125 VOLTS

cut-outs are rated at 30 amp., 125 volts, and are furnished in single, double and triple-pole main pipes and single and double branches.

Fixture Holder with Interchangeable Receptacles

The holder sockets which the Adams-Bagnall Electric Company of Cleveland, Ohio, manufactures for use with its standard "Abolite" industrial lighting reflectors are now being equipped with the new type standard P. & S. keyless receptacle. The keyless bottom can be exchanged for the P. & S. "Shurlock" type or for a pull-chain bottom. This is a very desirable feature, the maker points out, since when a receptable breaks it is usually the lower part which can now be replaced immediately by dealers from jobbers' stocks in that city.

Simply Constructed Electric Flatirons

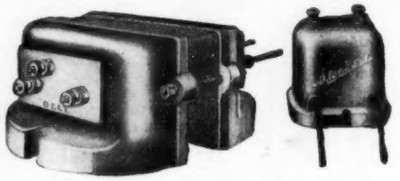
Access may readily be had to the heating element, which can be removed and replaced in less than one-half minute in the iron recently placed upon the market by the Satisfaction Guaranteed Electric Works, 11 South Desplaines Street, Chicago. The iron consists of a one-piece casting in the shape of the flatiron with the broad element chamber providing a "sole plate."

The chamber opens at the rear end of the flatiron, and the heating element is placed in the chamber through the open end. After connecting the element by two binder head screws, the name plate which fastens to the iron with two screws covers the rear opening of the iron completely.

Another feature of the electric iron is the construction of the element itself. It is so made that it is possible to use a considerable length of resistance wire of comparatively large cross-sectional area. Connection is made with the outside of the iron by means of two short pieces of wire which form a cable with the knot lying in a recess of an insulating block. The other end of the cable, surrounded by a short coil spring, terminates in a separable plug. Any strain on the cord separates the plug instantaneously without damage to the attachments at either end of the cord.

Porcelain-Clad Bell-Ringing Transformers

Light-weight and rugged porcelain bell-ringing transformers, both light-duty and heavy-duty types, have recently been placed upon the market by the Standard Transformer Company of Warren, Ohio. Some of the advantages of these transformers are that they will not rust or corrode, are insulated



WILL NOT RUST OF CORRODE; BUZZING AND HUMMING ELIMINATED

against grounds, fire, etc., are non-resilient and thus eliminate buzzing or humming noise. The residence type is rated at 15 watts and is designed for 100 volts to 230 volts at 25, 40, 50 and 60 cycles. The low-voltage winding gives a potential of 11 volts on open circuit and is inductively wound so that a short-circuit on this winding will not damage the transformer.

Heavy-duty types, which are designed for apartments, schools, factories, etc., are rated at 50 watts and produce a voltage of 6-12 and 18. This allows flexibility for short and long bell circuits connected with the same instrument.

The cores on both the residence and heavy-duty sizes are made of silicon alloy steel. The coils are thoroughly impregnated and the cases are compound-filled, which makes the transformers weatherproof; hence they are not injured by being installed in a damp basement or other places where they may be exposed to conditions of moisture.

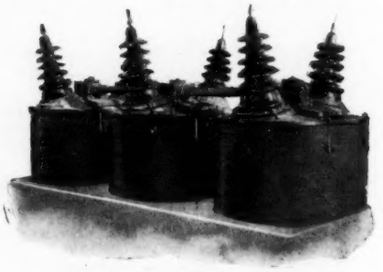
Washing Machine with Oscillating and Plunger Motion

The oscillating copper tub or drum of the "Gold Seal" electric washing machine now being marketed by the Philip Smith Manufacturing Company of Sidney, Ohio, moves not only backward and forward but also upward and downward. There is no dead center to the tub, the maker points out, so that the clothes are kept in constant motion. The water and the suds travel through the clothes in a path which resembles a figure eight in two directions, the maker says. In this way a thorough and quick cleaning of the clothes is effected.

Rigidness and quietness in operation result from proper construction of the washer, which has a neat appearance, is compactly built and can be moved through any average-width doors, its over-all dimensions being 27 in. by 29 in. (69 cm. by 74 cm.). The swinging wringer with which the washing machine is equipped has a safety release and safety stops. The controls are conveniently located and the transmission cases are packed with non-fluid oil to insure permanent lubrication.

Easily Installed 125-Kv. Oil Circuit Breaker

Complete housing of the control is the main feature of the 125-kv. oil switch recently placed upon the market by the Pacific Electric Manufacturing Company, 827 Folsom Street, San Francisco, Cal. The housing is made of two telescoping tubes arranged so that the units used need not be accurately spaced, and the control is operated by



CONTROL IS COMPLETELY HOUSED

means of a square rotating shaft with bevel gears.

The gears of this switch can be spaced at any distance apart on the shaft, making the installation labor very small. In fact, a switch of this type has been

installed, wired and filled with oil in two working days.

Current transformers for operating an overload release are supported on the contact brackets, the secondary wiring being led through the control tunnel. The switch is equipped with manholes, permitting the adjustment and inspection of the parts by a man sitting inside the tanks.

Device for Pulling Fuses from Block

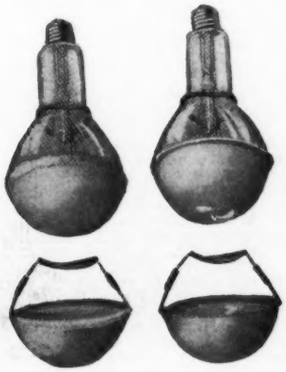
For the removing and replacing of fuses in cut-out blocks L. M. Mitchell, P. O. box 480, Waterbury, Conn., has developed and is manufacturing the wood and fiber device shown in the accompanying illustration. The jaws

ALLOWS THE EASY REMOVAL AND REPLACEMENT OF FUSES

which grasp the fuses are made of hard fiber, which insures good insulation, and the frame is made of hard wood. The device is placed around the fuse with the handle in such a position that the jaws are open, and when the handle is pulled out the jaws tighten around the fuse and withdraw it from the block.

Opal-Glass Lamp Caps and Glare Shields

Opal-glass lamp caps and glare shields for industrial lighting use have recently been brought out by the Adams-Bagnall Electric Company of Cleveland, Ohio. The lamp caps are made of opal glass having good diffusion with low absorption of light. They closely fit the bulbs of gas-filled (Mazda C) lamps, being held in position by coiled spring holders, and hide the lamp filament and further cut-down glare. The caps are especially fitted for use with reflectors that would not otherwise afford sufficient eye protection.



OPAL CAP FOR 100-WATT LAMP AND GLARE SHIELD FOR 200-WATT LAMP

The glare shields are made of white porcelain-enameled steel in shape to conform to the lamp bulb, being held in position by the same style of coiled-spring holders as are used on the lamp caps. The shields are useful with flat and shallow dome reflectors for protecting the eyesight from the lamp filaments. The porcelain-enameled steel is easily cleaned and does not break when dropped.

The glass lamp caps are made for lamps in 75, 100-150, 200, 300, and 400-500 watt sizes and the glare shields in these sizes with the exception of the 75-watt.

Electric Floor Scrubbing and Polishing Machine

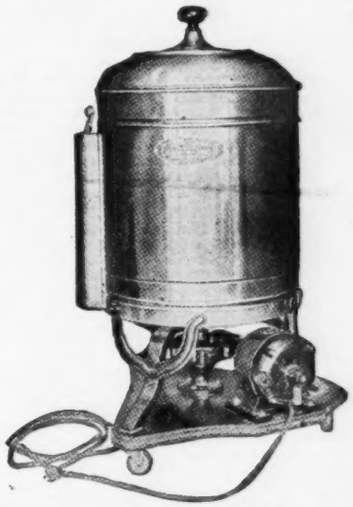
The "E-Z" electrically operated floor scrubbing and polishing machine which has recently been brought out by the John Herr Manufacturing Company of Philadelphia applies both the water and the cleaning powder to the floor as it scrubs. For all floor surfaces other than wood and linoleum the operator fills the upper tank of the machine with water and the lower one with grit powder which is automatically sprinkled over the floor. Where wood or linoleum floors are to be cleaned water and a soap powder are mixed in the upper tank. Floors can also be readily wax-polished with the machine. The operations of the machine are regulated and controlled by the operator by moving the handle of the machine and through pressing the foot treadle at the back.

APPLIES WATER AND CLEANING POWDER TO FLOOR SURFACE

A space 18 in. (46 cm.) wide is scrubbed by this machine, which can be used right up to the baseboard and weighs slightly over 100 lb. (45 kg.). The construction of the floor scrubbing mechanism is declared to be very simple, the two circular brushes being connected to the electric motor by only three gears having extra large teeth. All the parts are oversize and all bearings run in grease. The machine is connectable with the ordinary lamp socket and is equipped with a push switch on the handle.

Home-Size Electric Dishwashing Machine

Dishes, glassware and silver can be washed clean, sterilized and dried in the "Whirlpool" electric dishwasher, which is being manufactured by the Whirlpool Manufacturing Company, 1629 Chestnut Street, Philadelphia. The machine is made entirely from copper and is ornamental in type. It is driven by a 110-volt, 1-hp. General Electric motor, wound for either direct current or alternating current, and the entire machine is mounted on 2-in. (5-cm.) casters. This allows the machine to be removed from the dining room to the kitchen after loading dishes in two receiving racks. A propeller in the bottom of the machine throws the water against the dishes from every angle. The used water can be drawn off into a pail, or, if preferred, the dishwasher can be connected with the plumbing.



TWO RECEIVING RACKS ALLOW DISHES TO BE TAKEN FROM THE DINING ROOM DIRECTLY TO THE KITCHEN

NOTES ON RECENT APPLIANCES

Motor-Driven Two-Wheel Grinder

An electric surface grinder is being manufactured by C. L. Hayes, 12 Adams Street, Ashtabula, Ohio.

White-Glass Lighting Fixture

A three-section white-glass lighting fixture has just been placed upon the market by the St. Louis Brass Manufacturing Company, St. Louis, Mo.

Electric Scraping Machine

The Rotary Scraper Company, Inc., 17 Battery Place, New York, is marketing an electrically driven machine for removing rust and paint from metallic surfaces, and for drilling, reaming, etc.

Manufacturers' Activities

ROSSE GIBSON has resigned from the Gibson Electrical Supply Company, Oakland, Cal., to open an electrical supply house in Oakland.

GOULDS MANUFACTURING COMPANY, Seneca Falls, N. Y., manufacturer of pumps, will open on Sept. 1 a district sales office in Detroit, Mich. This office will be in the Dime Bank Building and will be in charge of E. B. Gould, who has recently returned after eighteen months' service in France.

HOLTZER-CABOT OUTING.—The employees of the Holtzer-Cabot Electric Company, Roxbury, Mass., held their annual outing on Aug. 9. The steamer Rose Standish was chartered exclusively for the electrical workers, the company acting as host. Starting from Boston, the Rose Standish docked at Plymouth.

THE NORTH EAST ELECTRIC COMPANY, Rochester, N. Y., has started work on a new $255,000 addition to its plant in Whitney Street. The building will add 66,000 sq.ft. to the present capacity of the factory, and it is expected that it will be completed about the first of next year. The Rochester service station, which formerly occupied the space now being used for the new building, is now on Lyell Avenue.

THE PAGE STEEL & WIRE COMPANY has opened a branch office in Chicago at 29 South La Salle Street. This office will handle all Armco iron products, including welding rods, twisted pairs, plain and galvanized strand, bond wires, barbed wire and fence manufactured by the company. This company has another new branch office in the Book Building, Detroit. Distribution in Canada is in the hands of Taylor & Arnold, Ltd., Montreal, Toronto and Winnipeg.

FREMONT WILSON, consulting engineer, who has returned to New York to resume his practice after a year spent in charge of construction work in one of the large shipyards, has recently been asked to report on the cost of equipping three bituminous-coal prospects with modern machinery throughout. He would appreciate catalogs, bulletins, data sheets, prices, etc., from manufacturers or agents. For the next three weeks this information may be sent to his residence, 444 Riverside Drive.

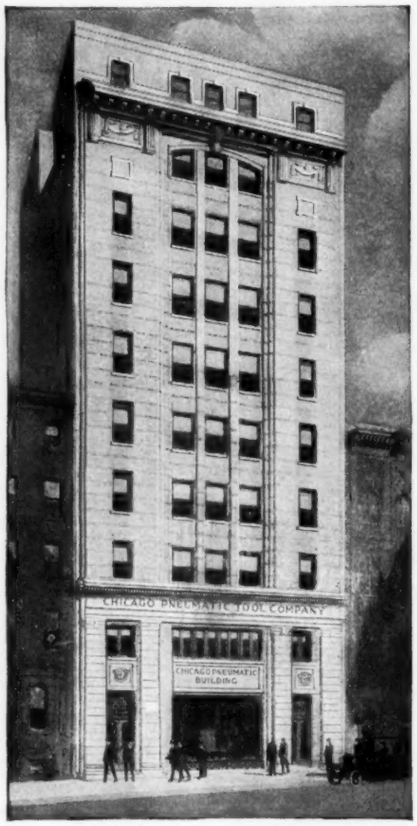
THE ALLIS-CHALMERS MANUFACTURING COMPANY, for the quarter ended June 30, 1919, shows unfilled orders on hand totaling $14,756,197, as compared with $17,921,117 on March 31, and $28,962,096 on June 30, 1918. The statement for the quarter ended June 30, 1919, for sales billed, compares with the corresponding periods of previous years as follows: 1919, $7,734,025; 1918, $9,238,079; 1917, $6,551,574, and 1916, $5,106,130. For the six months ended June 30 and corresponding periods for previous years the following sales were billed: 1919, $16,336,917; 1918, $15,827,906; 1917, $11,625,290, and 1916, $9,480,970.

THE FIRST NATIONAL BANK OF BOSTON has purchased the Equitable Building on Milk Street, comprising an area of over 20,800 sq.ft., to erect thereon a new building which will be one of the finest banking houses in the country. This bank has extended its foreign business largely during the past few years. It established the First National Corporation a short time ago, and still more recently, in connection with the Comptoir National d'Escompte de Paris and the National Bank of Commerce in New York, organized the French American Banking Corporation. The branch at Buenos Aires, Argentina, which was established about two years ago, has $25,000,000 deposits.

NATIONAL LAMP WORKS INSURES EMPLOYEES.—A large group contract went into effect on July 31 when all the employees of the National Lamp Works of the General Electric Company came under the protection of the Travelers' Insurance Company. These employees occupy several plants and are estimated at 11,000 in number. As the amount per capita is between $500 and $1,000, nearly $10,000,000 life insurance is involved. Each employee who has been with the company for three months is to receive $500 life insurance. Those who have been with the company one year will receive $600 and from that time on $100 will be added each year until the amount reaches $1,000.

ELECTRIC APPLIANCE COMPANY, Seattle, Wash., has moved from 118 Spring Street to 1214 Third Avenue, where a large storeroom has been fitted up for handling general electric appliances. The company specializes in washing and ironing machines.

THE CHICAGO PNEUMATIC TOOL COMPANY plans moving its general offices from Chicago to New York and toward this end is erecting an office building at 6-8 East Forty-fourth Street, New York City. The structure, which is shown in the accompanying illustration, is being built by the Westinghouse-Church-Kerr Company, is of combination steel, brick and limestone, and will comprise ten stories, all to be occupied by the company. The ground



NEW YORK OFFICE BEING BUILT FOR CHICAGO PNEUMATIC TOOL COMPANY

floor is to be a permanent exhibition room. In conjunction, a completely equipped service station will be maintained. The operation of the company's six plants and twenty-six sales and service branches can be directed more economically from New York. There will be continued in Chicago a sales and service organization more extensive than formerly. The new building is to be ready for occupancy early in 1920, at which time the transfer will be effected.

THE JEANNIN ELECTRIC COMPANY, Toledo, Ohio, which was recently incorporated for $170,000, is about to bring out a new repulsion-induction motor. The company has a factory at 110 Eleventh Street, where experimental work has been going on for the past five months. The company is now prepared to make motors and states that it has enough orders on hand to keep it going for some time. Carl H. Clement, who is president of the company, was for a number of years connected with the Bock Bearing Company of Toledo, and H. W. Jeannin, vice-president, was connected with the Wagner Electric Company for seven years and also with the Century Electric Company for a similar period. The secretary of the company is M. C. Seely.

WALTER LASSEN and R. D. COLEMAN, Bremerton, Wash., have opened an electric shop in that city.

THE ROLLER-SMITH COMPANY announces that an agency arrangement has been made with L. B. Gottschall, 211 North St. Paul Street, Dallas, Tex., who will handle the company's lines of instruments, meters and circuit breakers in Texas, with the exception of a small portion in the western part of the State.

THE ACME WIRE COMPANY of New Haven, Conn., announces that owing to the increasing volume of its business in the Middle West and the desirability of keeping in closer and more frequent touch with the requirements of customers, it has opened an office at 521 Guardian Building, Cleveland, Ohio, where it will be represented by J. T. Crippen.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has recently announced that its new East Springfield (Mass.) works will hereafter produce small power motors and automobile starting, lighting and ignition equipment. Arthur B. Reynders, formerly director of production of the East Pittsburgh works, has been made works manager at East Springfield.

D. R. DELWILER and W. W. KELLANS, formerly with the Westinghouse Electric & Manufacturing Company, have organized the Delwiler & Kellans Electric Company at Oklahoma City. They will also have a store at Tulsa, Okla. They are the agents of the Isko ice machine. W. C. Looney and H. T. Bonar have been engaged to fill their place as salesmen with the Westinghouse company.

THE INDUSTRIAL TRUCK COMPANY, Holyoke, Mass., manufacturer of the Cowan truck, is adding two new floors to its factory to meet the requirements of increasing business. A total of 40,000 sq.ft. is included in the addition, which will augment existing facilities by about 75 per cent. An entire floor will be devoted to the manufacture of industrial electric trucks, giving about four times the space at present available for this product.

THE DONGAN ELECTRIC MANUFACTURING COMPANY, Detroit, Mich., manufacturer of low-voltage transformers and electrical measuring instruments, has completed arrangements with the Sierra Electric Company, 515 Market Street, San Francisco, Cal., to act as its Western distributer for the States of Washington, Oregon, California, Montana, Idaho, Utah, Nevada and Arizona. A complete stock of bell-ringing and heavy-duty transformers will be kept at the above address to insure proper and satisfactory service throughout this territory.

THE GREEN ENGINEERING COMPANY, East Chicago, Ind., announces the appointment of the firm of Bull & Livensparger as its sales representatives in Chicago and northern Illinois territory. They have taken charge of its Chicago sales office, 14 East Jackson Boulevard, serving in all matters pertaining to proposals for Green chain-grate stokers, "Sealflex" arches, steam-jet ash conveyors, cast-iron ash tanks and allied products and replacements. E. H. Bull has served the company as an engineer for the past seven years, and D. A. Livensparger has been a member of the sales force for nine years.

THE FRANK RIDLON COMPANY, Boston, Mass., has acquired a controlling interest in the American Electric Service & Maintenance Company, Springfield, Mass., and the Hallstone Electric Company, Brockton, Mass. The Springfield organization's headquarters are at 51 Taylor Street, and the plant has been strengthened by the transfer of all the machinery and equipment of the Ridlon company from its former location on Lyman Street, Springfield, to the Taylor Street establishment. It is hoped to increase the staff by about fifty men, all skilled in the repair and reconstruction work. Facilities are now in hand for the testing of motors up to and including 500 hp. The Brockton organization will henceforth be known as the Hallstone-Ridlon Company, and the Springfield and Brockton establishments, the former retaining its name unchanged, will draw upon the headquarters stock of motors and other electrical machinery at Boston, now aggregating $250,000 in value. Motor, transformer, generator and other repairs will be handled in both cities with the object of saving as much time as possible to customers in central New England, and in the near future it is planned to establish another branch of the organization at Hartford, Conn.

Foreign Trade Notes

ELECTRICAL EXPORTS FROM UNITED KINGDOM INCREASING.—Electrical apparatus exports from the United Kingdom covering the period from January to May, inclusive, 1918, amounted to practically $4,500,000. However, during the same period in 1919 these exports increased to $8,200,000.

CHINESE TELEPHONE CONDITIONS. —The telephone business of Shanghai, China, has increased so rapidly that it has been impossible to connect any new lines since December, 1918, owing to the congestion of the central switchboard. It had been decided not to install an automatic service, as it was much cheaper to employ Chinese operators.

PROPOSED NEW WIRELESS INSTALLATION FOR MADEIRA. — The Portuguese government is considering purchasing from the British Navy the wireless installation now at Madeira for Porto Santo and procuring a more powerful apparatus for Madeira. Firms interested should communicate with the Minister of Commerce, Lisbon, Portugal.

THE NEW CUSTOMS TARIFF OF NICARAGUA.—The Bureau of Foreign and Domestic Commerce is issuing a complete translation of the customs tariff of Nicaragua, with a convenient summary in the way of an introduction. This new tariff, effective March 1, 1918, differs in important respects from previous tariffs and should be studied by every one interested in trade with Nicaragua.

THE EDWARD MARSHALL SYNDICATE, INC., Times Square, New York City, announces that it has on the ground in Germany, England, France, Sweden and Italy able men competent to watch every detail of the foreign trade situation, to cover the European commercial field in every way for different trades and to supply complete information with regard to American opportunities in the Continent of Europe.

TRADE DIRECTORY OF SOUTH AUSTRALIA.—To meet the requirements of American business men who wish to make connections with houses in South Australia, the Bureau of Foreign and Domestic Commerce, Washington, D. C., has prepared a directory of manufacturers, wholesale dealers, retail dealers, agents and exporters in that state. Only the most important firms have been included, and the list has been carefully checked and rechecked.

PROPOSED NEW LINE IN CANTON. —The municipality of Canton, China, is offering a franchise for the construction of an electric railway 10 miles long around the city, upon the site of the old city walls, which are being demolished. A copy of the terms upon which the franchise will be granted can be obtained from the Far Eastern Division, Bureau of Foreign and Domestic Commerce, Washington, D. C. (Refer to file No. 119,907.)

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THE AMERICAN ELECTRIC IMPORT COMPANY, Copenhagen, Denmark, has its main office and warehouse at Copenhagen, with branches at Stockholm and Christiania. Other branches are to be organized in Finland, Poland, Russia and possibly in Germany. The merchandise carried by this company consists of electrical apparatus, electrical supplies and raw material used by the electrical trade, but only American goods will be sold. A partial list of manufacturers whose products will be handled is as follows: Wagner Electric Manufacturing Company, St. Louis, Mo.; Simplex Electric Heating Company, Cambridge, Mass.; Hart & Hegeman Manufacturing Company, Hartford, Conn.; Connecticut Telephone & Electric Company, Meriden, Conn.; Roller-Smith Company, New York; Electric Heating Apparatus Company, Newark, N. J. The president of the company is P. W. Gumaer, formerly with the General Electric Company at Pittsfield, Mass.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A business man in France (No. 30,190) wishes to secure the representation of exporters of electrical implements. Correspondence should be in French.

A firm in Russia (No. 30,201) desires to extend commercial connections with the United States and is in the market for electrical implements. Correspondence may be in English.

An American firm (No. 30,206) whose South American manager is leaving shortly for Brazil and Argentina desires to secure agencies for the sale in those countries of electrical supplies.

A coöperative society in Belgium (No. 30,199) desires to secure agencies for the sale of electrical specialties, cables, copper wire, insulated wire, switches, insulating materials, connectors, cotton for winding wire and laminated iron. Quotations should be given c.i.f. Antwerp. Correspondence may be in English.

A commercial agent in Belgium (No. 30,212) desires to secure an agency on commission for the sale of complete equipment for electrical illuminating motors and generators, alternators (25 and 50 cycles usual), transformers and complete equipment for transmission of electrical energy. Correspondence should be in French.

Trade Publications

CURRENT TAPS AND MULTIPLE PLUGS.—These are the subject of two circulars for dealers' use being distributed by Harvey Hubbell, Inc., Bridgeport, Conn.

ELECTRIC RANGES.—An electric range sales service manual is being distributed by the Hughes division of the Edison Electric Appliance Company, Inc., 5660 West Taylor Street, Chicago.

FLEXIBLE METAL TUBING.—Several kinds of flexible metal-hose tubing and accessories are described in a bulletin compiled by the Breeze Manufacturing Company, Newark, N. J.

STORAGE BATTERIES.—Storage batteries for power and light plants are described and illustrated in the circular just issued by the Prest-O-Lite Company, Inc., 30 East Forty-second Street, New York.

THEATER DIMMERS.—For the information of theater electricians, contractors, architects and others interested in the control of lighting effects in legitimate and "movie" theaters, as well as large halls, etc., the Cutler-Hammer Manufacturing Company of Milwaukee has prepared a booklet entitled "C-H Theater Dimmers."

TRANSMISSION AND DISTRIBUTION EQUIPMENT.—Cable end bells, switchboard and bus-rack structural devices, copper connections, indoor switching and protective equipment, insulating supports, outdoor switching and protective equipment and insulator pins are described and illustrated in a comprehensive bulletin being distributed by the Electrical Engineers' Equipment Company, Chicago.

ELECTRIC ARC WELDING.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently issued a publication covering the process of electric arc welding and the necessary apparatus for this process. In this bulletin the different processes of welding, such as autogenous welding, forge welding, oxy-acetylene welding, thermit welding and arc welding, are compared, and the advantages of the latter process are shown.

ELECTRICAL PRECIPITATION. — A very attractively illustrated and printed booklet of twenty-four pages has just been published by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. It is entitled "Electrical Precipitation," and it deals with the recovery of valuable material from smoke and gases. The necessary apparatus for the precipitation process, such as motor-gas generators, transformers, rectifiers, motors, switchboards and accessories, are shown and are described in detail in this circular, whose number is 7375.

ELECTRIC WELDING APPARATUS.—Bulletin 700, issued by the U. S. Light & Heat Corporation, Niagara Falls, N. Y., illustrates some actual installations. Descriptions of apparatus are given.

STORAGE BATTERIES.—A sketch of the development of the "Iron-Clad Exide" battery, manufactured by the Electric Storage Battery Company of Philadelphia, is given in a booklet now being distributed.

FARM-LIGHTING PLANTS.—The Dayton Electrical Manufacturing Company, of Dayton, Ohio, is distributing bulletin No. 55, which describes and illustrates its electric lighting plants for country homes.

VIBRATING-TYPE RECTIFIER. — The Cambridge vibrating rectifier for alternating-current 60-cycle use is covered in a bulletin which the Clapp-Eastham Company of Cambridge, Mass., has recently issued.

SOOT CLEANERS.—The Vulcan Soot Cleaner Company, Dubois, Pa., illustrates and describes the Vulcan diagonal method for cleaning soot from the tubes of horizontal water-tube boilers in bulletin No. 451, which it has just published.

THREE-PHASE ALTERNATING-CURRENT WELDING OUTFIT.—The E. J. Wiggins Electrical Corporation, 722 Main Street, Buffalo, N. Y., has prepared a circular which sets forth the advantages of its three-phase alternating-current electric welding outfit.

LIGHT-CHANGING SOCKET.—"Turn Down Your Electric Light" is the title of a circular which the Wirt Company of Germantown, Pa., has issued to show the application of its "Dim-A-Lite" socket, which gives five changes of light with the same lamp bulb.

BELL-RINGING TRANSFORMERS. — The Thordarson Electric Manufacturing Company, 501 South Jefferson Street, Chicago, has printed a circular entitled "Thordarson Transformers," in which it illustrates and describes several types of its bell-ringing transformers.

ELECTRIC MINING APPARATUS.—Electric mining apparatus installed in the plant of the St. Louis Smelting & Refining Company at St. Francois, Mo., is especially described in a bulletin entitled "Mine Duty Apparatus," being distributed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis.

New Incorporations

THE DALMATIA (PA.) LIGHT COMPANY has been incorporated with a capital stock of $5,000 by J. F. Brosius and others.

THE BAKERSVILLE (N. C.) MILLING, LIGHT & POWER COMPANY has been incorporated by R. T. Teague, Charles G Ellis and C. M. Murchison, all of Bakersville.

THE GENERAL ELECTRICAL SUPPLY COMPANY of Eastland, Tex., has been chartered with a capital stock of $5,000 by R D. Mahon, W. N. Hart and A. K. Bass, Jr.

THE JEANNIN ELECTRIC COMPANY of Toledo, Ohio, has been incorporated with a capital stock of $150,000 by C. H. Clement, M. C. Seeley, J. I. O'Connor, S. L. McNary and H. W. Jeannin.

THE EISEHUT STORAGE BATTERY COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $10,000 by H. C. Eisenhut and George T. Egensteiner, 804 Seneca Avenue, Brooklyn.

THE CARBON IMPROVEMENT COMPANY, 17 East 107th Street, New York, N. Y., has been incorporated with a capital stock of $50,000 to manufacture carbons. The incorporators are H. Schiff, R. W. Kreivert and J. Goldman.

THE SWANSON ELECTRIC & MANUFACTURING COMPANY of Evansville, Ind., has been incorporated by Albert Swanson, Byron F. Persons and C. Howard Battin. The company is capitalized at $35,000 and proposes to deal in electrical supplies.

THE PAGE BATTERY COMPANY of Norfolk, Va., has been incorporated with a capital stock of $25,000 to do a general automobile and battery repair business. The officers are: Percy A. Page, president; W. R. Butcher, secretary, and Charles M. C. Doran, treasurer, all of Norfolk.

New England States

LUBEC, ME.—The city of Lubec is considering the erection of a municipal lighting plant, which would cost in the neighborhood of $25,000.

PORTSMOUTH, N. H.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to install a 1000-kw. turbo-generator at the local navy yard, to cost about $17,000. (Specification 4017.)

ADAMSDALE, MASS. — Arrangements are being made for the installation of an electric lighting system. Energy will be obtained from the municipal electric plant at North Attleboro.

BOSTON, MASS.—Plans have been completed by the New England Telephone & Telegraph Company for the erection of a new exchange building at Essex and Oxford Streets.

BROCKTON, MASS.—The Edison Electric Illuminating Company of Brockton will soon commence work on the new lighting system to be installed in Brockton. This lighting system will cover the most important business sections of Brockton.

NEEDHAM, MASS.—Arrangements have been made by the Needham Tire Company for an issue of $600,000 in capital stock, the proceeds to be used for extensions to its plant, including a power house.

NEW BEDFORD, MASS.—The New Bedford Gas & Edison Electric Light Company is laying a conduit from Acushnet Avenue and Blackmer Street to the site of the Holmes mill for the purpose of supplying electricity to operate the mill.

PEABODY, MASS.—The Peabody City Council voted to appropriate $1,000 for an investigation by an expert of the municipal electric light plant.

TAUNTON, MASS.—The Taunton municipal lighting plant has petitioned the Board of Gas and Electric Light Commissioners for permission to extend its electric transmission lines into the town of Berkeley.

PROVIDENCE, R. I.—The Nightingale-Morse Mills will erect a hydroelectric power plant to cost about $80,000 at their branch works at Putnam, Conn.

PROVIDENCE, R. I.—Arrangements are being made by the Atlantic Mills, Equitable Building, Boston, Mass., for the erection of a three story, 46-ft. by 98-ft. power plant at their local works on Manton Avenue.

WOONSOCKET, R. I.—The French Worsted Company has completed plans for the construction of a new addition to the boiler plant at its works. The structure will be about 40 ft. by 50 ft. and is estimated to cost $35,000. Contract has been awarded to Wilfred Aubin, 1103 Diamond Hill Road.

HARTFORD, CONN.—The Public Buildings Commission has voted in favor of a central heating and power plant on the Connecticut Boulevard.

HARTFORD, CONN.—The Hartford Electric Light Company has applied to the Board of Street Commissioners for permission to extend its electric transmission line across the Connecticut River from the Black Avenue substation.

NEW HAVEN, CONN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 12 for a motor-driven triplex pump in the United States post office at New Haven.

NEW LONDON, CONN.—The Lord Electric Company of New York City has been awarded the contract for lighting, heating and the oil distribution system at the submarine base, in addition to the water system, by the Bureau of Yards and Docks. The Lord Electric Company's bid was $248,000.

SOUND BEACH, CONN.—The Dalton Manufacturing Corporation, 1915 Park Avenue, New York, N. Y., has purchased a site at Sound Beach for its proposed new plant. Contract has been awarded to Richard Deeves & Son, 309 Broadway, New York City, for the erection of four factory buildings and a power house. The plant will be equipped with electric motor-driven machinery.

Middle Atlantic States

BROOKLYN, N. Y.—The Bureau of Yards and Docks, United States government has awarded a contract to B. Diamont, 12 Bergen Street, for extending the substation at the local naval station.

GLENS FALLS, N. Y.—The City Council has voted to enter into a contract with the Adirondack Electric Power Corporation for the installation of an ornamental lighting system in the business section for a period of five years. The cost is estimated at about $12,000.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

HADLEY, N. Y.—The Hadley Light & Power Company, Inc., Hadley, N. Y., has made application to the Public Service Commission, Second District, for permission to construct a power plant in Hadley.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Sept. 10 for construction, including heating, sanitary and electric work, of building for acute patients at Kings Park (N. Y.) State Hospital. Drawings and specifications etc., may be obtained at the Department of Architecture, Capitol, Albany. L. F. Pilcher, Capitol, Albany, is state architect.

NEW YORK, N. Y.—Considerable electrical and mechanical equipment will be required for the new cold-storage plant to be erected at 780 First Avenue by the United Dressed Beef Company, First Avenue and Forty-fourth Street, to cost $250,000.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 4 for a temporary boiler plant, etc., at the United States Marine Hospital, attendants' quarters at Stapleton, N. Y. Copies of plans and specifications may be obtained at the above office or from the supervising chief engineer, 731 Custom House, New York City.

NIAGARA FALLS, N. Y.—The Niagara Falls Gas & Electric Light Company, Riverway, is planning to erect a new power plant on Buffalo Avenue and Twenty-Second Street, to cost about $200,000.

OSWEGO, N. Y.—The capital stock of the People's Gas & Electric Company has been increased from $1,000,000 to $1,300,000, the proceeds to be used for extension and improvements to its system.

SYRACUSE, N. Y.—Contract has been awarded by the United States-Hoffman Company for extension, one story, 80 ft. by 200 ft., and a power house, 40 ft. by 60 ft., to cost, with equipment, about $100,000, to Dawson Brothers of Syracuse.

TROY, N. Y.—Sealed proposals for construction, heating, sanitary and electric work, State Armory, Troy, N. Y., will be received by Col. Franklin W. Ward, secretary State Board of Armory Commissioners, 158 State Street, Albany, N. Y., until 3 o'clock on Thursday, Sept. 4, when they will be publicly opened and read. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Albany, N. Y. L. F. Pilcher, State Architect.

WATERTOWN, N. Y.—Arrangements have been completed by the Northern New York Utilities Corporation for the erection of its proposed hydroelectric power plant on the Black River near Watertown, to cost about $250,000. The building contract has been awarded to the Walsh Construction Company of Watertown.

BORDENTOWN, N. J.—The engine plant of the Bordentown Brick Company was damaged recently by fire, causing a loss of about $10,000.

GLOUCESTER CITY, N. J.—The City Council is considering an appropriation of $45,000 for the installation of new pumping equipment at the municipal waterworks.

TRENTON, N. J.—The installation of a new ornamental lighting system along Saniham Creek, from Calhoun Street to the Log Basin section, forming an extension to the present park lighting system, is under consideration by the City Commissioners. It is proposed to use arc lamps.

TRENTON, N. J.—Bids will be received by the City Commission of Trenton, N. J., until Aug. 29 for furnishing and erecting at the Calhoun Street pumping station, Trenton, one 25,000,000-gal. steam-driven centrifugal pump, one 20,000,000-gal. electrically driven centrifugal pump, one generator, one motor, with appurtenances, connections, etc. Plans and specifications may be obtained at the office of the Water Department, for which a charge of $10 will be made. Alvin Bugbee is superintendent.

CATASAUQUA, PA. — Plans are under consideration by the Playground Association for the installation of a new electric lighting system at its grounds.

CARLISLE, PA.—C. H. Masland & Sons, Amber and Westmoreland Streets, Philadelphia, Pa., will erect a one-story power plant, 30 ft. by 94 ft., in connection with its new plant at Carlisle for the manufacture of carpets. Lockwood, Greene & Company, 101 Park Avenue, New York, N. Y., are architects.

DINSMORE, PA.—The Greensburgh & Connellsville Coal & Coke Company is planning the installation of a new power plant in connection with the erection of a new coal tipple at its local properties.

ERIE, PA.—Preliminary plans are being prepared by the Osborn Engineering Company, 2848 Prospect Avenue, Cleveland, Ohio, for the erection of a power plant for the Continental Rubber Company, Nineteenth and Liberty Streets, to cost about $75,000.

GROVE CITY, PA.—Plans are being prepared for an addition to the municipal electric light plant, to cost about $50,000. Sidney B. Martin, Penn Building, Pittsburgh, is engineer.

HERSHEY, PA.—The Hershey Chocolate Company will erect a power plant, in connection with the proposed addition to its works, to cost about $500,000.

PHILADELPHIA, PA.—The erection of an electric transformer station is under consideration by the board of managers of the Lankenau Hospital, Corinthian and Girard Avenues.

PHILADELPHIA, PA.—Bids will soon be asked by the Department of Health and Charities for furnishing equipment for power house at the Philadelphia General Hospital, Thirty-fourth and Pine Streets, including boilers, engines, piping, etc. The cost is estimated at about $250,000. P. H. Johnson, 713 Sansom Street, is engineer.

PITTSBURGH, PA.—The plant of the Miller-Owen Electric Company, Lexington Avenue and Thomas Boulevard, was recently damaged by fire, causing a loss of about $50,000.

PITTSBURGH, PA. — Contracts have been awarded by the Duquesne Light Company to Dwight P. Robinson & Company, 61 Broadway, New York, N. Y., for the construction of its proposed electric generating plant at Cheswick. The initial installation will have a generating capacity of 60,000 kw., and provision will be made for an ultimate output of 120,000 kw. The cost of the plant, with transmission lines, substations and distributing system, is estimated at $15,000,000.

SCRANTON, PA.—The Maccar Truck Company, Cliff Street, contemplates the erection of a power plant on Mulberry Avenue, to cost about $60,000. Davis & Lewis, Union Bank Building, are architects.

WAYNESBORO, PA. — Tentative plans for the erection of a municipal electric light plant are under consideration by the City Council.

WARREN, MD.—The Warren Manufacturing Company is planning to build a new power plant in connection with the proposed addition to its work, to cost about $250,000. The cost of the power plant is placed at $35,000.

WASHINGTON, D. C.—The installation of mechanical equipment and piping in boiler room at the local navy yard, to cost about $200,000, is under consideration by the Bureau of Yards and Docks, Navy Department. (Specification 3708.)

WASHINGTON, D. C.—Sealed proposals will be opened in the Treasury Department, supervising architect's office, Washington, D. C., for alterations to lighting fixtures, etc., in the United States post office and court house, Detroit, Mich., in accordance with drawings and specifications, copies of which may be had at the supervising architect's office or at the office of the custodian, Detroit, Mich. James A. Wetmore, acting supervising architect.

North Central States

FLINT, MICH.—Plans have been completed by the McCann-Harrison Company, Sloan Building, Cleveland, Ohio, for heating and power and complete mechanical equipment for the new spring plant of the Standard Parts Company at Flint.

VERONA, MICH.—The Union Steam Pump Company is building a machine shop in connection with its proposed works. The first unit of the proposed plant will cost about $500,000.

DELAWARE, OHIO.—Preparations are being made by the Rainbow Tire & Rubber Company for the erection of a manufacturing plant in Delaware. The first building will be 100 ft. by 300 ft., two

stories. A power house will also be erected to supply power to operate the proposed plant.

LIMA, OHIO.—Plans are under consideration by the Lima Locomotive Works for the construction of an electric power plant, to cost about $125,000, provided that the Ohio Electric Railway Company does not proceed with its plans to enlarge its local plant.

NEW PHILADELPHIA, OHIO.—The Tuscora Rubber Company is planning to erect a plant at New Philadelphia, to include a main building, 70 ft. by 500 ft., a power house, 40 ft. by 100 ft., and an office building, 60 ft. by 60 ft.

HAZARD, KY.—The Kentucky & West Virginia Power Company, recently chartered with a capital stock of $6,000,000, will take over the properties of the Kentucky River Power Company of Hazard, the Tug River Electric Company of Springs, W. Va., and the Logan County Light & Power Company of Logan, W. Va. These plants cost approximately $2,500,000, and have several hundred miles of transmission and distributing lines, which will be extended and connected in order to serve several hundreds of coal plants and small towns in Kentucky and West Virginia with electricity for lamps and motors. R. E. Breed, president of the American Gas & Electric Company, is president of the new company. The main offices will be in the Land Title Building, Philadelphia, Pa.

WOLF PIT, KY.—The McKinney Steel Company is planning the construction of a new power plant at its works to cost around $60,000.

LAPORTE, IND. — Improvements and extensions are contemplated by the Advance-Rumely Company, including the erection of a new storage shed, three additions to machine shop, enlarging the case-hardening and heat-testing departments, and improvements to its power plant.

CHICAGO, ILL.—Bids will soon be asked by Gardner & Lingberg, engineers, 38 South Dearborn Street, for the erection of a ten-story cold storage warehouse on Fulton and Morgan Streets, for the Fulton Market Company, to cost about $4,000,000.

COLUMBIA, ILL.—Bonds to the amount of $16,000 have been voted for extensions and improvements to the municipal electric light plant.

DUNDEE, ILL.—The Public Service of Northern Illinois has submitted a proposal to the Village Board of West Dundee for the installation of new lamps throughout the village. The company offers to replace the present lamps of 40 cp. with lamps of 60 cp. There are seventy-one lamps in the residence district.

RARITAN, ILL.—The installation of an electric lighting system in Raritan is under consideration. A fund of $2,500 has been raised by subscription as a bonus for promotion of the project.

HORTONVILLE, WIS.—The village of Hortonville has contracted with the Wisconsin Traction, Light, Heat & Power Company of Appleton for lighting the streets of the village. The Wisconsin company is planning to extend its transmission lines to Dale, Medina and Sherwood, and will also supply electricity to farmers along the lines.

ST. PAUL, MINN.—A municipal electric power plant to furnish light and heat for the city and county buildings is being advocated by Commissioner McColl. He proposes taking St. Peter Street below the bluff along the edge of the Mississippi River as a site for a power plant.

ST. PAUL, MINN.—The City Council has decided to reduce the cost of the ornamental lighting system for University Avenue from Rice Street to the west city limits. The ordinance as passed on July 9 called for the installation of a five-lamp cluster system, to cost about $104,840, and the later resolution calls for a single-lamp system to cost about $64,032.

GRINNELL, IOWA.—Application has been made by the Iowa Light, Heat & Power Company of Grinnell to extend its electric transmission lines into O'Brien County.

KNOXVILLE, IOWA. — The Marion County Electric Company has petitioned the State Railroad Commission for permission to extend its transmission lines in Marion County.

SPENCER, IOWA.—The town officials are considering extending the municipal electric light system to furnish electricity to several towns and farming districts.

BUTLER, MO.—Improvements to the municipal electric light plant and waterworks system are under consideration.

KANSAS CITY, MO.—Bids will be received by the purchasing agent of Kansas City, City Hall, Kansas City, Mo., until Sept. 17, for designing and constructing one steam-driven pumping unit to have a capacity of 50,000,000 gal. per twenty-four hours. Bids are invited on two types of pumping units as follows: (A) For centrifugal type of pump driven by steam turbine through reduction gears; (B) centrifugal type of pump driven by a vertical cross-compound Corliss engine. W. G. Goodwin is chief engineer and superintendent. J. Ray Samuel is purchasing agent.

Southern States

MARSHVILLE, N. C.—Bonds to the amount of $300,000 have been voted for the installation of an electric lighting system. The Southern Power Company of Charlotte will furnish electricity to operate the proposed system.

PENSACOLA, FLA.—Plans have been completed by the Bruce Dry Dock Company, Pensacola, Fla., for the construction of a new drydock, to cost about $450,000. The structure will have five floating pontoons, each 40 ft. by 100 ft. and 10 ft. deep, with shop buildings for construction and repair work. About twenty electrically operated centrifugal pumps will be installed for emptying the dock.

HOLLANDALE, MISS.—Bids will be received by the city of Hollandale until Sept. 4 for improvements to the municipal electric light plant and waterworks, including electric generators, switchboard, and street-lighting equipment, deep-well pumping set, etc. Xavier A. Kramer of Magnolia is consulting engineer.

MARVEL, ARK.—The Marvel Light & Ice Company is planning to erect a fireproof building and to install new equipment, including a 200-hp. oil engine and a 20-ton ice-making machine. The company recently increased its capital stock from $20,000 to $40,000. I. E. Freeman of Earl is enginer.

DERIDDER, LA.—At an election to be held Aug. 19 the proposal to issue $100,000 in bonds for installation of municipal electric light plant and waterworks system will be submitted to the voters.

NEW ORLEANS, LA.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for mechanical and electrical equipment for power plant at the local navy yard, to cost about $115,000. (Specification 3882.) A deposit of $10 is required for plans.

TISHOMINGO, OKLA.—Plans are being prepared for improvements to the electric lighting system, for which $60,000 in bonds have been voted.

BRYAN, TEX.—The city of Bryan is in the market for the purchase of an electric generating unit, consisting of a 225-hp. Diesel engine directly connected to a 60-cycle, three-phase, 2300-volt generator of not less than 150-kw. rating. J. W. Greer is city manager. At an election to be held Aug. 28 the proposal to issue $75,000 in bonds for the purchase of the plant of the Bryan Power Company will be submitted to the voters.

DALLAS, TEX.—The Dallas Hotel Company, it is reported, contemplates doubling the capacity of the power plant in the Adolphus Hotel, at a cost of about $20,000.

EL PASO, TEX.—The City Council is considering the erection of an electric substation at the sewage disposal plant, and to install a gasoline engine for emergencies.

Pacific and Mountain States

HOQUIAM, WASH.—Plans have been completed by the Commercial Club for the installation of a curb lighting system on Eighth Street, between the depot and bridge, and on I Street, from Fourth to Ninth Street. The Gray's Harbor Railway & Light Company will install and maintain the system, which will consist of forty-eight lamps.

SEATTLE, WASH.—Plans are being prepared by Daniel Huntington, city architect, for the proposed building to house the new unit of the Lake Union steam plant, recently authorized by the City Council, for which an appropriation of $1,500,000 has been made. Six new boilers and a third unit consisting of a 12,500-kw. turbo-generator will be installed. Two boilers will be installed at once, which will increase the output of the plant by 4500 kw.

BEND, ORE.—The Bend Water, Light & Power Company will soon begin work on the installation of a new 1000-kw. steam-driven electric generating plant, to cost approximately $100,000. Plans for a $125,000 plant on Tumalo Creek, work on which was to have been started shortly, will be held up until next summer.

PORTLAND, ORE.—The Franks Laundry Company is contemplating the erection of a laundry at East Seventh and Pine Streets, to cost about $50,000. The proposed plant will be operated by electricity.

SALEM, ORE.—The installation of a municipal electric light plant, to cost about $225,000, is under consideration.

LOS ANGELES, CAL.—Specifications for the installation of conduits, to be installed when the new street is paved, for a future ornamental lighting system on New Broadway, between Tenth and Eleventh Streets and Twelfth and Pico Streets, have been approved by the City Council.

MARE ISLAND, CAL.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to install 4000-kw. turbo-generators at the local navy yard, to cost about $45,000. (Specification 4018.)

MARE ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 27, for furnishing and installing transformers, wires, cables, metal conduits, fittings, fixtures, reflectors, switches, receptacles, panelboards and cabinets necessary for complete electric lighting and power systems for the structural shop at the Navy Yard, Mare Island. Drawing and specifications No. 3982 may be obtained on application to the above bureau or to the commandant of navy yard, Mare Island, upon deposit of $10.

OAKDALE, CAL.—Plans for the erection of a power plant and reservoir to supply electricity to the plant at the mines of the Calaveras Copper Company in Copperopolis are contemplated by this company.

OAKLAND, CAL.—Plans have been prepared by the Pacific Wool Corporation for the construction of a plant, consisting of warehouse, scouring plant, spinning shop, office building, power house and wharf, to cost about $800,000. J. M. Haenke, care Palace Hotel, San Francisco, is architect.

RAISIN CITY, CAL.—The Fresno County Board of Supervisors has authorized the Raisin City lighting district to continue with its work of street lighting in accordance with the vote recently taken.

SAN BERNARDINO, CAL.—The Southern California Edison Company has commenced work on the rebuilding of the company's lines in San Bernardino and vicinity. The first unit of the new work is the building of a joint pole line on Sixth Street between E and D Streets and then south to Court Street.

SAN DIEGO, CAL.—Arrangements have been made by H. N. Savage, city hydraulic engineer, with the San Diego Consolidated Gas & Electric Company for the erection of an electric transmission line to Barrett dam near San Diego.

SANGER, CAL.—The city trustees have decided to erect a new street-lighting system and will install an electrolier system on the main streets.

BOISE, IDAHO.—The Idaho Power Company plans to erect a transmission line to connect its eastern and western systems in southern Idaho, and it is proposed to build a line from Shoshone Falls to American Falls to connect at the latter place with the Utah Power & Light Company's system.

MANTI, UTAH.—Plans are being prepared by F. G. McGonagle, engineer, Salt Lake City, for improvements to the municipal electric light plant, to cost about $25,000.

MESA, ARIZ.—Bond to the amount of $25,000 have been authorized for extensions to the municipal electric light plant and sewer systems.

Canada

BERWICK, N. S.—Bids will be received by B. C. Thompson, secretary of water commissioners, until Aug. 30 for improvements to the municipal electric lighting system, including the construction of concrete and timber dam wood-stave flume, power house and wheel pit, etc., to cost about $27,500. S. E. March of Berwick is engineer.

BIGGAR, SASK.—The Biggar Electric Light & Power Company has awarded contract for construction of an electric light plant to W. J. Lay.

(Issued July 29, 1919)

1,311,567. MOTOR CONTROLLER; Wilmar F. Lent, Milwaukee, Wis. App. filed April 8, 1915. Series-wound switch.

1,311,568. PROCESS AND APPARATUS FOR PRODUCING NITROGEN COMPOUNDS, ESPECIALLY NITRIDES; Axel R. Lindblad, Stockholm, Sweden. App. filed May 14, 1918. Removal of product facilitated.

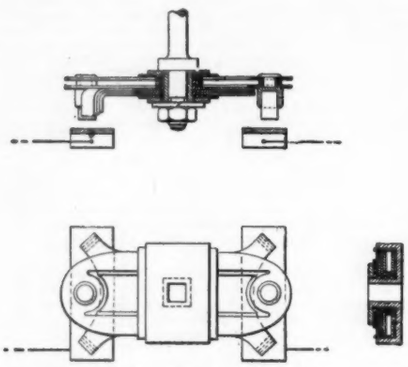
1,311,594. PROCESS OF AND APPARATUS FOR OBTAINING OXIDES OF NITROGEN FROM ATMOSPHERIC AIR; Francis I. du Pont, Wilmington, Del. App. filed March 26, 1915. Air-current-directed.

1,311,615. STEAM TURBINE; Johann F. M. Patitz, Milwaukee, Wis. App. filed March 24, 1913. Speed-controlled.

1,311,634. ANNUNCIATOR; Henry J. Appleton, Detroit, Mich. App. filed Dec. 4, 1918.

1,311,648. RELAY; Richard M. Hopkins, New York, N. Y. App. filed June 15, 1917. Buzzing eliminated.

1,311,649. SIGNALING SYSTEM; Richard M. Hopkins, Rutherford, N. J. App. filed March 13, 1918.



1,311,974—Electric Switch

1,311,650. SIGNAL SYSTEM; Clarence C. Johnson and Joseph F. D. Hoge, New York, N. Y. App. filed June 15, 1917.

1,311,654. RADIO METHOD AND APPARATUS; Frederick A. Kolster, Washington, D. C. App. filed March 31, 1916.

1,311,661. REFILLABLE CARTRIDGE FUSE; Clarence T. McDonald, Chicago, Ill. App. filed May 28, 1917. Blade-terminal type.

1,311,662. SIGNAL APPARATUS; Charles McKeever, Jersey City, N. J. App. filed March 2, 1918.

1,311,725. SECONDARY COIL; Shojiro Takasaki and Jutaro Miyamoto, Shiga-Ken, Japan. App. filed March 14, 1917.

1,311,754. CONTROL FOR ELECTRIC MOTORS; Eugene R. Carichoff, Schenectady, N. Y. App. filed April 24, 1917. Variations in voltage compensated.

1,311,763. CIRCUIT-CLOSER OPERATOR; William D. Eaton, Glen Echo, Md. App. filed Sept. 4, 1918.

1,311,784. CONTROLLER; Louis A. White, Brooklyn, N. Y. App. filed Dec. 18, 1914. Adaptable.

1,311,789. WELDING APPARATUS; William G. Abbott, Jr., Wilton, N. H. App. filed Feb. 5, 1918. Prevents shunting of current through blades.

1,311,808. METHOD AND MEANS FOR AVOIDING INTERFERENCE; Bancroft Gherardi, Bayhead, N. J. App. filed Dec. 5, 1918.

1,311,849. COUPON-COUNTING MACHINE; Bert M. Snapp, Balboa, Canal Zone. App. filed Sept. 28, 1918.

1,311,854. ENGINE-STARTING DEVICE; Joseph Bijur, New York, N. Y. App. filed July 7, 1914.

1,311,859. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 13, 1916. Abrupt speed changes eliminated.

(Issued Aug. 5, 1919)

1,311,881. ATTACHMENT FOR FIRE-ALARM BOXES; Peter Eifried, Passaic, N. J. App. filed Nov. 16, 1918.

1,311,893. TIMER-DISTRIBUTER MECHANISM; Edward R. Hodges, Irvington, N. J. App. filed Nov. 19, 1917.

1,311,899. FLASHLIGHT; Morduch L. Kaplan, Brooklyn, N. Y. App. filed Sept. 18, 1914.

Record of Electrical Patents

Notes on United States Patents

1,311,902. ELECTRIC MAKE-AND-BREAK DEVICE; Joseph H. Lehman, Hasbrouck Heights, N. J. App. filed Nov. 6, 1917. Oscillatory member.

1,311,904. BRUSH HOLDER; Samuel C. McKeown, East Orange, N. J. App. filed Sept. 25, 1917.

1,311,915. DISTRIBUTING APPARATUS; Paul M. Rainey, Glen Ridge, N. J. App. filed April 7, 1919.

1,311,916. LIGHTNING ARRESTER; William Reid, Chicago, Ill. App. filed Dec. 14, 1918.

1,311,974. ELECTRIC SWITCH; Franz Kratz, Stuttgart, Germany. App. filed April 30, 1914. Large-contact surface, quick break.

1,311,977. INSULATOR BRACKET; William D. Kyle, Milwaukee, Wis. App. filed Aug. 2, 1915. Secure attachment.

1,311,997. SIGNAL DEVICE; Joseph A. Reischmann, Jr., Milwaukee, Wis. App. filed Oct. 2, 1916.

1,312,016. ADJUSTABLE SPARK-PLUG TESTER; Ralph E. Beeman, Minneapolis, Minn. App. filed Oct. 28, 1918.

1,312,021. MOTIVE-POWER MEANS FOR UTILIZING THE ENERGY OF AIR CURRENTS; William J. Dickinson, Erith, England. App. filed Feb. 21, 1918.

1,312,038. STORAGE-BATTERY CONNECTION; Albert H. Lugrman, Cincinnati, Ohio. App. filed Nov. 23, 1917. Loosening of connection eliminated.

1,312,039. ELECTRIC WELDING; Charles F. Melink, Toledo, Ohio. App. filed May 22, 1916.

1,312,064. ELECTRICAL APPARATUS; Chris L. Volz, Cleveland, Ohio. App. filed Feb. 15, 1919. Rectifier.

1,312,068. INDUCTIVE WIRELESS-TELEPHONE SYSTEM FOR RAILROADS AND THE LIKE; Victor G. Werner, Baden, Sweden. App. filed May 10, 1916.

1,312,069. INDUCTION-FURNACE HAVING UNIDIRECTIONAL CIRCULATION; James R. Wyatt, Philadelphia, Pa. App. filed Aug. 29, 1918. Motor effect intensified.

1,312,076. TROLLEY; Steve Kalma, Braddock, Pa. App. filed Feb. 28, 1919. Ready manipulation.

1,312,092. MAGNETIC CHUCK; William Arter, Worcester, Mass. App. filed June 28, 1917.

1,312,109. AUTOMOBILE SIGNAL; Vernon A. Doty, West Springfield, Mass. App. filed Jan. 7, 1916.

1,312,123. AUTOMATIC HEAT AND COLD REGULATOR ALARM; Bennett W. Jordan, Mullins, S. C. App. filed Dec. 22, 1914.

1,312,126. TELEPHONE-EXCHANGE SYSTEM; Alben E. Gundell, New York, N. Y. App. filed March 24, 1917.

1,312,136. CIRCUIT BREAKER; Daniel M. Schiffert, Boston, Mass. App. filed Dec. 9, 1916.

1,312,165. VOLTAGE-REGULATING SYSTEM; Roswell E. Cullings, Wilkinsburg, Pa. App. filed Aug. 10, 1918. Quick response.

1,312,183. CONTROL OF ELECTRIC MOTORS; Pearl N. Jones, Pittsburgh, Pa. App. filed Dec. 17, 1915. Short-circuit period prolonged.

1,312,191. SIGNALING SEALING DEVICE FOR VALVES, ETC.; George P. McDonnell, St. Louis, Mo. App. filed Oct. 10, 1918.

1,312,208. ELECTRIC CIRCUIT MAKER AND BREAKER; Christian Rasmussen, Cleveland, Ohio. App. filed March 26, 1919. Rotatable union.

1,312,220. PORTABLE ELECTRIC LIGHT; George W. Wacker, Rutherford, N. J. App filed March 7, 1918. Battery securely retained.

1,312,221. PORTABLE ELECTRIC LIGHT; George W. Wacker, Rutherford, N. J. App. filed May 25, 1918. Pocket type.

1,312,229. ELECTRIC IGNITING DEVICE; Alfred W. Bell, Milan, Tenn. App. filed Nov. 1, 1916.

1,312,243. METHOD OF PRODUCING WOOD SEPARATORS; Thomas F. Ferry, St. Louis, Mo. App. filed Dec. 7, 1918.

1,312,254. ELECTRODE FOR ELECTRIC ARC SOLDERING; Ernest H. Jones, London, Eng. App. filed April 11, 1918.

1,312,255. ELECTRODE AND PROCESS OF MAKING SAME; Jesse C. King, Montreal, Que., Canada. App. filed May 22, 1916. Roughened surface retains casing.

1,312,256. ELECTRODE; Jesse C. King, Montreal, Que., Canada. App. filed Oct. 9, 1917. Double casing.

1,312,257. ELECTRODE; Jesse C. King, Montreal, Que., Canada. App. filed Oct. 9, 1917. Protection against wasting.

1,312,258. ELECTRODE; Jesse C. King, Montreal, Que., Canada. App. filed Oct. 9, 1917. Magnesite coating.

1,312,259. ELECTRODE; Jesse C. King, Montreal, Que., Canada. App. filed Oct. 9, 1917. Dolomite coating.

1,312,260. ELECTRODE; Jesse C. King, Montreal, Quebec, Canada. App. filed Oct. 9, 1917. Bauxite coating.

1,312,261. ELECTRODE; Jesse C. King, Montreal, Que., Canada. App. filed Oct. 9, 1917. Chromite coating.

1,312,262. ELECTRODE; Jesse C. King, Montreal, Que., Canada. App. filed Oct. 9, 1917. Zerconium coating.

1,312,270. DENTAL IMPLEMENT; Percy Russell, Philadelphia, Pa. App. filed Nov. 2, 1916.

1,312,273. ELECTRIC CONTROLLING APPARATUS; William Schwagermann, Yonkers, N. Y. App. filed April 24, 1917. Control magnet with simple armature.

1,312,282. CIRCUIT BREAKER; John R. Spurrier, Bethlehem, Pa. App. filed Sept. 11, 1916. Auxiliary switch.

1,312,347. SEALING-WAX APPLIER; William H. Ogden, Philadelphia, Pa. App. filed April 19, 1919.

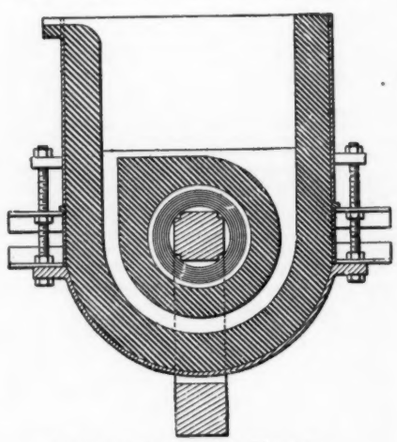
1,312,368. SPARK INTENSIFIER; Oscar A. Thompson, Redwing, Kan. App. filed Sept. 26, 1918.

1,312,373. SOUND PRODUCER; John H. Wheelock, Worcester, Mass. App. filed July 18, 1917.

1,312,374. PICTURE-PROJECTING APPARATUS; Joseph R. White, Washington, D. C. App. filed Dec. 16, 1914.

1,312,380. ELECTRIC SWITCH; Ernst G. K. Anderson, Chicago, Ill. App. filed March 7, 1914. Snap type.

1,312,386. CONTROLLING CIRCUITS OF PALLET-ACTUATING MAGNETS FOR AUTOMATIC ORGANS; John H. Compton, Nottingham, Eng. App. filed Dec. 26, 1916.



1,312,069—Induction Furnace

1,212,407. RAILWAY-CROSSING SIGNAL AND CONTROL THEREOF; Lloyd V. Lewis, Edgewood Borough, Pa. App. filed Aug. 21, 1916.

1,312,433. TRANSLATING CIRCUITS; John R. Carson, New York, N. Y. App. filed Oct. 10, 1918.

1,312,454. CIRCUIT-CONTROLLING MECHANISM; Estelle C. Raney, Columbus, Ohio. App. filed April 29, 1915. Opening and closing points adjustable.

1,312,480. METHOD OF REFINING ZINC; Sven Huldt, Stockholm, Sweden. App. filed April 3. 1917. Uniform operation.